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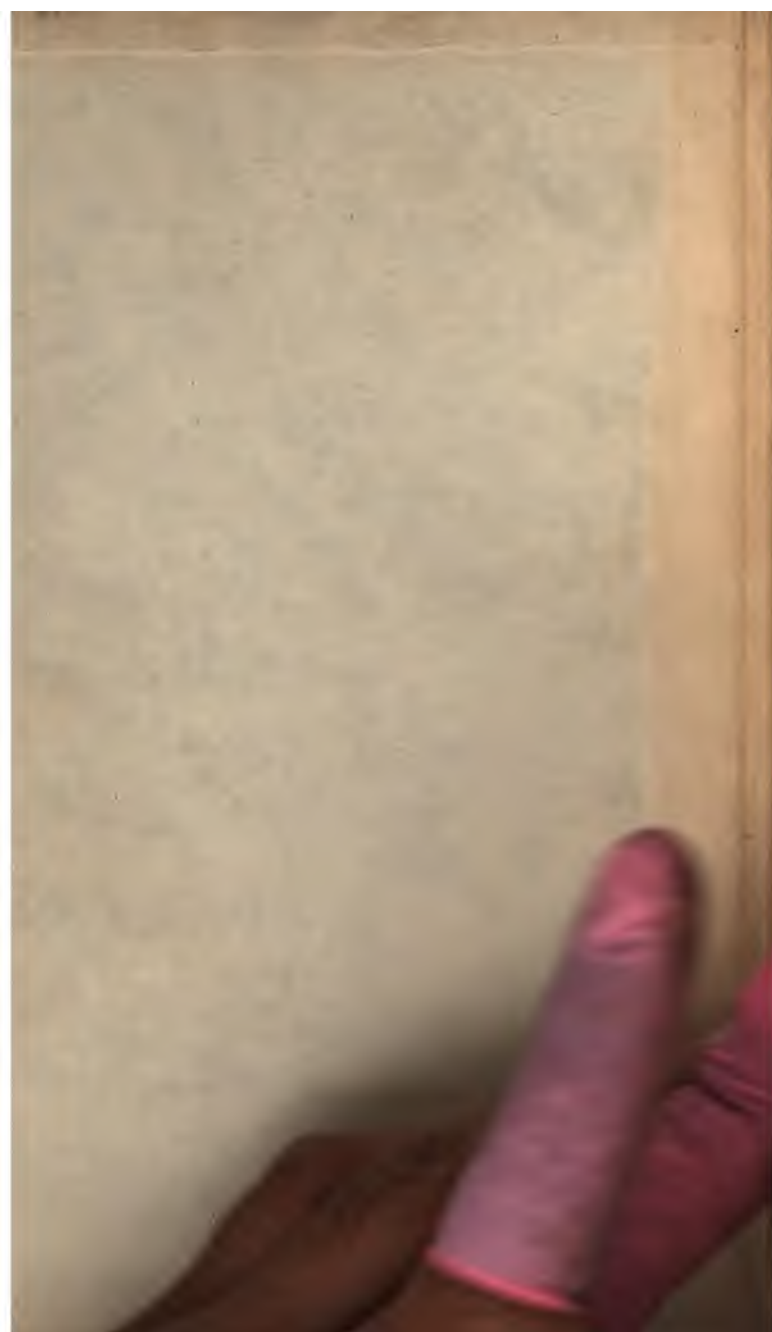
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Roberts



THE PUPILS' ARITHMETIC
PRIMARY BOOK
PART TWO



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THE PUPILS' ARITHMETIC

PRIMARY BOOK

PART TWO

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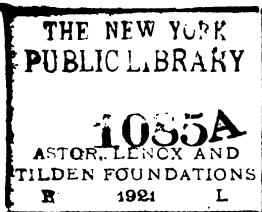
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George III



PREFACE

THE PUPILS' ARITHMETIC is an effort to meet current criticism of methods and results in the teaching of elementary arithmetic.

The manner in which the authors plan to regain for our schools that mechanical skill in computation which characterized an older time, while retaining what is valuable in modern theory and practice, is aptly epitomized in the title,—**THE PUPILS' ARITHMETIC**.

Part One covers the work of the first three years of school; Part Two, the work of the fourth year.

The authors have made prominent the following features:

I. A large number of exercises in pure arithmetic, affording abundant practice in the mechanical operations.

II. A large number of problems in applied arithmetic, affording practice in gleaning thought from the printed page and in applying the arithmetical principles previously learned.

III. The careful grading of the exercises and problems, the avoidance of long numbers and lengthy processes in problem work, the regular alternation of exercises in abstract number on the one hand, and concrete problems on the other. The exercises, both abstract and practical, have been devised and arranged for oral work, seat work, and class drill.

IV. The model solution of problems by the shortest and most direct of the approved methods of computation.

V. The variety and interesting character of the problems. Occasionally, the problems are grouped about a central idea. However, since such grouping, when forced, frequently leads the teacher away from her object, the authors have elected generally to classify the problems about the mathematical principle or process upon which their solution depends. In the problems almost every phase of life that attracts children is touched upon. Undue prominence is not given to problems in dollars and cents. The *idea of rate* is presented in its manifold aspects of consumption, expenditure, growth, speed, production, accretion, etc. The language used is simple though not childish; stereotyped forms of stating problems have been avoided. Many words and phrases which may require explanation are printed in italics. Such explanation, together with the reading aloud

of problems, serves to remove those difficulties of language which frequently are the real cause of an apparent weakness in arithmetic.

The whole of this volume is designed for pupils' use either in recitations or in study-periods during the fourth school-year. Material for seat work and for home study will be found under the captions "Written Exercise" and "Written Problems." The examples classified as "Drills," "Oral Exercises," or "Oral Problems" are intended for use in recitation-periods, but may be utilized also as material for seat work to be done in a limited time. The rest of the subject-matter, embodying the exposition of principles, the explanations of processes, and the model types of solution, is designed for class use as exercises for reading and study.

In beginning a new topic a silent reading of the text by the pupils should be followed by audible reading and discussion.

Again, in assigning problems for solution teachers should guard against the difficulties of language. Such expressions as "how much more," "half as much again," "rate of speed," "total," "average," etc., express numerical relationships, and are as necessary a part of arithmetical instruction as the multiplication table; hence their meaning and use should be rendered familiar.

Multiplication and Division form the *core* of the

arithmetical work of the fourth year; for that reason the cross-references are given in connection with the sections devoted to those topics.

THE AUTHORS.

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PRIMARY ARITHMETIC

PART TWO

NOTATION AND NUMERATION

Numbers 1 to 10,000

Read these numbers :

1. 3.	6. 306.	11. 603.	16. 457.
2. 30.	7. 475.	12. 798.	17. 409.
3. 34.	8. 506.	13. 306.	18. 904.
4. 300.	9. 908.	14. 897.	19. 600.
5. 340.	10. 757.	15. 900.	20. 701.

What is the largest number that we can write with three figures ?

What number is 1 more than 999 ?

Beginning with 0, count by one thousand until nine thousand is reached.

We write one thousand in this way : 1,000.

Write two thousand, three thousand, four thousand, etc., to nine thousand.

If we add 1,000 and 100, we have one thousand one hundred, which we write 1,100.

Write two thousand three hundred.

Write five thousand six hundred.

If we add 1,000 and 10, we have one thousand ten, which we write 1,010.

Write one thousand thirty.

Write six thousand seventy.

Write eight thousand eighty.

Write one thousand one hundred ten.

Write four thousand seven hundred fifty.

Write five thousand one hundred eighty-five.

Write nine thousand seven hundred forty-two.

If we add 1,000 and 1, we have one thousand one, which we write 1,001.

Write :

One thousand four.

Three thousand seventy-five.

Two thousand six.

Six thousand ninety-two.

Eight thousand five.

Five thousand six hundred seven.

Four thousand nine.

Two thousand five hundred forty.

Nine thousand seven.

Eight thousand ninety-seven.

Read the following :

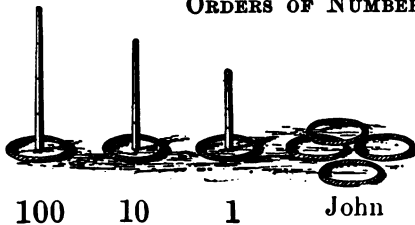
2,060	7,640	1,010	7,019
7,084	3,097	2,020	8,020
3,901	2,007	3,094	4,607
7,438	6,070	7,087	3,080
6,009	4,809	6,501	7,003
9,089	8,702	7,208	9,009

Write the following in figures :

1. Five thousand three hundred forty-seven.
2. One thousand eight hundred ninety.
3. Six thousand two hundred seven.
4. Eight thousand ninety-eight.
5. Two thousand four hundred.
6. Seven thousand seventy.
7. Three thousand.
8. Four thousand two.

READING EXERCISE

ORDERS OF NUMBERS



100

10

1

John

Mary

William

Julia

Total

HUNDREDS	TENS	ONES
2	2	2
1	1	4
2	4	
1		5

H T O
SCORE CARD

Do you know how to play the game of ring-toss?

John, Mary, William, and Julia played one game and wrote their scores on a score card like the one in the picture.

What was John's score? Mary's? William's? Julia's? What was their total score?

What is the value of the 2 in the T column compared with the 2 in the O column?

Write the scores without ruling the columns:

John	222
Mary	
William	
Julia	

What new figure must you use in writing William's score and Julia's score?

Strike out the 0 in 240; what number remains?

Strike out the 0 in 105; what number remains?

What is the use of the 0 in writing a number like 240 or 105?

In a number like 549, the right-hand figure (9) is in units' (or ones') place, the middle figure (4) is in tens' place, and the left-hand figure (5) is in hundreds' place. Each of these *places* is called an *order*; in a number of three figures, like 549, there are three *orders*, — the order of units, the order of tens, the order of hundreds.

In a number of four orders, like 7,549, the left-hand figure (7) is in the *order of thousands*.

It is easier to read a large number if a comma is put between the hundreds' place and the thousands' place, *e.g.* 7,549; 6,280; 10,000.

ORAL EXERCISE

Name the orders of each figure in the following numbers :

- | | | |
|---------|---------|-----------|
| 1. 239. | 3. 62. | 5. 1,300. |
| 2. 406. | 4. 750. | 6. 2,070. |
7. Count by 10's from 10 to 100.
8. Count by 100's from 100 to 1,000.
9. Count by 1,000's from 1,000 to 10,000.

Numbers to 100,000

COUNTING BY 1,000's TO 20,000

We may count thousands as we count units: 1 thousand, 2 thousand, 3 thousand, 4 thousand, etc.

1. Count by thousands from 1 thousand to 20 thousand.

2. Write in a column the numbers you have counted; opposite each number, write the same number in words: *e.g.* One thousand

Two thousand

COUNTING BY 10,000's TO 100,000

We may count ten-thousands as we count tens: 10 thousand, 20 thousand, 30 thousand, etc.

1. Count by ten-thousands from 10 thousand to 100 thousand.

2. Write in a column the numbers you have counted.

EXERCISE

Read these numbers :

6,954	11,060	70,000
10,400	20,400	85,700
7,090	30,000	9,010
15,280	41,250	90,010
27,600	16,096	99,099

Write in figures :

1. Fifteen thousand nine hundred eighty.
2. Twenty-seven thousand nine hundred sixteen.
3. One hundred fifty thousand eight hundred fifty.
4. Three hundred twenty-four thousand one hundred nine.
5. Seven hundred thousand five hundred forty-six.

Numbers above 100,000**COUNTING BY 100,000's TO 1,000,000**

We may count hundred-thousands as we count hundreds: 100 thousand, 200 thousand, etc.

1. Count by hundred-thousands from 100 thousand to 1,000 thousand.

2. Write in a column the numbers you have counted :

100,000

200,000, etc.

One thousand thousand (1,000,000) is called a million.

We may count millions as we count units : 1 million, 2 million, 3 million, etc.

3. Count by millions from 1 million to 20 million, and write the numbers as you count them.

1,000,000

2,000,000

3,000,000, etc.

WRITTEN EXERCISE

Make a chart like the picture.

Hundred-billions	Ten-billions	Billions	Hundred-millions	Ten-millions	Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units
4TH PERIOD BILLIONS			3D PERIOD MILLIONS			2D PERIOD THOUSANDS			1ST PERIOD UNITS		

Write these numbers on your chart, being careful to write each figure in the proper column :

- | | | |
|-------------|----------------|-------------------|
| 1. 56,742. | 4. 1,000,000. | 7. 100,000,000. |
| 2. 107,600. | 5. 2,600,500. | 8. 1,000,000,000. |
| 3. 985,000. | 6. 34,200,000. | 9. 7,649,358. |



Ordinal Numbers

1. Beginning at the left, who is the first pupil? The third? The sixth? The ninth? The fifth? The seventh? The tenth? The eighth?
2. Beginning at the right, who is the first? The fourth? The sixth?
3. Counting from the left, what is John's place? William's?
4. Counting from the right, what is Mary's place? Jane's?

WRITTEN EXERCISE

1. Write the names of the ordinal numbers from 1 to 20.
2. After each name, write its abbreviation, thus:

first,	1st	seventh,	7th
second,	2d	eighth,	8th
third,	3d	ninth,	9th
fourth,	4th	tenth,	10th
<i>fifth,</i>	5th	eleventh,	11th
sixth,	6th	<i>twelfth,</i>	12th

thirteenth,	13th	seventeenth,	17th
fourteenth,	14th	eighteenth,	18th
fifteenth,	15th	nineteenth,	19th
sixteenth,	16th	twentieth,	20th

Look at these words closely. Which are easy to remember? How is *fifth* formed from five? *twelfth* from twelve?

Read the following :

17th, 23d, 65th, 80th, 31st, 72d, 93d, 11th, 6th, 29th, 40th, 61st, 103d, 207th, 625th, 500th, 874th, 750th, 1000th, 2500th.

Roman Notation

The figures 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 are known as Arabic numerals.

The Romans used *letters* in writing numbers. They used I, V, X, L, C, D, and M.

I	denotes	1.
V	"	5.
X	"	10.
L	"	50.
C	"	100.
D	"	500.
M	"	1000.

Other numbers are written by putting some of these letters together. Look carefully at the way in which the numbers from 1 to 10 are written in the Roman notation.

I denotes 1.	VI denotes 6.
II " 2.	VII " 7.
III " 3.	VIII " 8.
IV " 4.	IX " 9.
V " 5.	X " 10.

Look at VI, VII, and VIII. Tell why VI denotes 6; VII denotes 7; VIII denotes 8.

Look at IV and IX. Tell why IV denotes 4; IX denotes 9.

Write 10, 11, 12, and 13 in the Roman notation. Write 15, 16, 17, and 18. Write 14 and 19.

Look at these numerals:

XX denotes 20	(10 + 10).
XL " 40	(10 from 50).
LX " 60	(50 + 10).
XC " 90	(10 from 100).

We see that when X is placed before L, the value of L is decreased by 10; but when X is placed after L, the value of L is increased by 10. In the same way, XC denotes 90 and CX denotes 110.

The Roman numerals from I to XII are used on most clock dials. Some clockmakers use IIII instead of IV.

The chapters in a book are usually numbered by means of Roman numerals, as Chapter XXIX.

In inscriptions on monuments and public buildings, Roman numerals are used for dates; thus the year 1656 would be written MDCLVI. The Romans wrote 1900 in this way: MDCCCC. MCM is generally used at the present time.

Read the following:

1. I, V, X, L, C, D, M.
2. II, VI, XIII, XXV, XXXI, DC.
3. IV, IX, XL, XC, CD.
4. VII, XII, XXII, XXXV, XLI.
5. LVII, LXIII, LXXVI, LXXXI.
6. VIII, XIX, XXIX, XXXIII, LXXXVIII.

Write the following in the Roman notation:

1. 20, 30, 40, 50, 60, 70, 80, 90, 100.
2. 21, 32, 45, 56, 67, 78, 83.
3. 4, 9, 400, 900.
4. 19, 59, 89, 490.
5. 24, 36, 99.
6. 100, 500, 1,000, 1,500, 1,800, 1,900, 1,909.
7. The numbers 1 to 20 inclusive.
8. 22, 36, 47, 59, 102, 98, 77.

Writing Dollars and Cents

How many cents in one dollar?

How many cents in one half-dollar?

How many cents in one quarter-dollar?

How many cents in one dime?

We may write one dollar in this way, \$1. The sign \$ means dollar.

Write 2 dollars; 3 dollars; 5 dollars.

We write one dollar and ten cents in this way, **\$1.10**.
Note that the dollars are separated from the cents by a dot or period. The period is called the *decimal point*.

Write: 2 dollars and 50 cents.
 4 dollars and 75 cents.
 8 dollars and 95 cents.
 3 dollars and 5 cents.
 10 dollars and 9 cents.

You have learned to write ten cents in this way, 10 ct. It may be written **\$.10**. Six cents may be written, **\$.06**.

Write 75 cents; 68 cents; 9 cents; 3 cents.

Read: \$9.25	\$20.90
\$17.30	\$6.08
\$6.42	\$40.01
\$8.05	\$25.00
\$17.20	\$4.50

Write:

Nineteen dollars and twenty cents.
Forty dollars and eleven cents.
Six dollars and twelve cents.
Eighteen dollars and fifty cents.
Sixty dollars and forty-six cents.
Eight dollars and four cents.
Seventeen dollars and sixteen cents.
Eleven dollars and forty cents.
Thirty dollars and thirty cents.

ADDITION

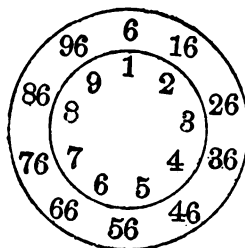
SIGHT EXERCISE

Addition by Decades

Add at sight and memorize :

1. Add 1 to each figure in the outer circle ; add 2 to each figure ; add 3, 4, 5, 6, 7, 8, 9.

2. Draw a diagram like the one in this exercise. Put the numbers 7, 17, 27, etc., in the outer circle.



Add 1 to each number in the outer circle ; add 2 to each number ; add 3, 4, 5, 6, etc.

SIGHT EXERCISE

Add at sight :

- | | | | | |
|-----------|-----------|-----------|-----------|-----------|
| 1. 69 | 2. 46 | 3. 83 | 4. 75 | 5. 57 |
| <u>10</u> | <u>20</u> | <u>30</u> | <u>40</u> | <u>50</u> |

ORAL PROBLEMS

1. How much money will you need to buy a six-cent book and a twelve-cent pencil box?

2. After there were 42 boys in our class, 3 new ones were admitted. How large was the class then?

3. Our teacher took some of the children to the Park: on Wednesday she took 8 boys and 10 girls; and on Friday, 6 boys and 4 girls. How many children did she take to the Park?

4. One boy picked 39 daisies and 20 buttercups. How many flowers did he pick?

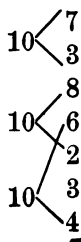
Suggestions for Rapid Addition

1. In adding, do not count or repeat numbers. In example 1 and in all other column adding, say, 9, 13, 19, 27—not, 9 and 4 are 13; 13 and 6 are 19, etc. Prove your answer by adding in the opposite direction.

Add:

1. 8	2. 3	3. 1	4. 2	5. 9	6. 8	7. 6	8. 4
6	5	3	4	3	7	9	9
4	7	5	6	1	4	2	6
9	4	7	8	5	9	8	7
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. A column of figures can be added more rapidly and more accurately by combining two or more of the figures that make 10.



Notice that 7 and 3 = 10; 8 and 2 = 10; 6 and 4 = 10. Therefore you can add 10, 20, 30, 33. After you have added a few columns in this way, you will learn to see the 10's without marking the numbers that make 10.

WRITTEN EXERCISE

NOTE. — Look for combinations of 10.

1. 7	2. 3	3. 7	4. 8	5. 4
8	1	3	7	1
3	4	6	2	5
2	7	9	1	6
1	1	2	9	4
5	5	4	6	8
6	6	7	3	0
5	8	1	4	3
4	5	4	5	4
8	2	5	5	3
—	—	—	—	—

Add, *looking for combinations of 10*:

6. 72	7. 635	8. 2598
46	429	5623
28	351	8412
34	675	2968
69	824	4137
<u>81</u>	<u>116</u>	<u>5346</u>

9. What is the sum of 64, 83, 23, 41, 79, 28, 36, 52?

10. A letter-carrier delivers — letters, — newspapers, — postal cards, and — magazines. Fill in the blanks with numbers of three orders, forming as many combinations of 10 as you can.

WRITTEN PROBLEMS

1. A clerk in the post office stamped 720 letters for Boston, 683 letters for Europe, 873 letters for New York, and 2,860 letters for other places. How many letters did he stamp?

2. In the same post office there were mailed 620 newspapers, and half as many magazines as newspapers. How many magazines and newspapers together?

3. On Monday there were sold in this office 786 stamps, on Tuesday 843 stamps, on Wednesday 600 stamps, on Thursday 790 stamps, on Friday 964 stamps, and on Saturday 1,200 stamps. How many stamps were sold during the week?

4. In this post office there were four men employed. One earned \$18 a week, one earned \$16 a week, and two others earned \$15 a week each. Find the amount of money paid to the four men.

5. The rent paid for this office was \$1,200; the lighting and heating cost \$240; the janitor was paid \$400. What was the total cost?

SIGHT EXERCISE

Addition by Decades

Add at sight and memorize.

1. Draw a picture like the one on page 13.

Write the numbers 8, 18, 28, etc., in the outer circle; write the numbers 1, 2, 3, etc., in the inner circle.

Add 1 to each figure in the outer circle; add 2 to each figure; 3, 4, 5, etc.

2. Draw a picture like the one on page 13.

Write the numbers, 9, 19, 29, etc., in the outer circle; add 1 to each figure in the outer circle; add 2 to each figure; 3, 4, 5, etc.

SIGHT EXERCISE

Add at sight:

1. 4	2. 5	3. 9	4. 8	5. 3
3	6	3	5	9
<u>8</u>	<u>4</u>	<u>7</u>	<u>6</u>	<u>4</u>

ORAL PROBLEMS

1. There are 30 days in April and 31 days in May. How many days in the two months?

2. There are four Saturdays and four Sundays in one month, and five Saturdays and five Sundays in the next month. How many Saturdays and Sundays in the two months?

3. A boy reads 1 hr. on each school day, 3 hr. on Saturday, and 5 hr. on Sunday. How many hours does he read during the week?

4. My father worked 54 hr. last week and 50 hr. this week. How many hours did he work during the two weeks?

WRITTEN EXERCISE

Add:

1. 21	2. 32	3. 43	4. 54	5. 65
76	87	98	19	28
37	46	55	64	73
82	91	11	22	33
44	55	66	77	88
99	14	25	36	47
58	69	70	15	26
60	37	48	59	71
82	93	16	27	38

WRITTEN PROBLEMS

1. A car ran 10 trips a day. The conductor collected fares from the following numbers of passengers: 18, 27, 29, 36, 34, 17, 23, 31, 29, 19. How many fares did he collect?

2. A subway train in New York had 7 cars, which were filled with passengers as follows: 116, 98, 107, 96, 99, 123, 119. How many passengers on the entire train?

3. From a train leaving the Grand Central Station in New York, 40 passengers left at Yonkers, 26 left at Peekskill, 79 left at Poughkeepsie, 14 left at Hudson, and all the others, 38, left at Albany. How many passengers had been on board?

4. This train made the trip in 4 hr. It went 35 mi. the first hour, 36 mi. the second hour, 37 mi. the third hour, and 35 mi. the last hour. How far is it from New York to Albany?

5. Trains come into Albany from several directions. 32 trains come daily from the south, the same number from the west, 12 trains from the north, and 9 trains from the east. How many trains come into Albany every day?

ORAL PROBLEMS

1. By putting 8 bottles and 13 bottles together, we get — bottles.
2. 27 marbles and 6 marbles are — marbles.
3. 7 books added to 25 books will make — books.

WRITTEN EXERCISE

Add:

1. \$ 1.07	2. \$ 2.78	3. \$ 4.65	4. \$ 9.63	5. \$ 8.26
4.96	6.46	2.37	2.11	1.38
<u>3.25</u>	<u>3.97</u>	<u>8.44</u>	<u>1.75</u>	<u>4.50</u>

WRITTEN PROBLEMS

1. In a certain school there are 10 rooms, containing 42, 40, 44, 43, 39, 47, 45, 44, 46, and 38 pupils respectively. How many pupils in the school?

2. In this school there are in use 460 readers, 284 arithmetics, 196 geographies, 224 histories, 75 music books, and 160 spellers. How many books in use?

3. How many sheets of paper were used in one week if the children used 640 sheets on Monday, 587 sheets on Tuesday, 625 sheets on Wednesday, 730 sheets on Thursday, and 1000 sheets on Friday?

4. In one class the pupils worked examples as follows: On Monday, 4. On Tuesday, 2 more than on Monday. On Wednesday as many as on Monday and Tuesday together. On Thursday, 6. On Friday, 10. How many examples were solved in the five days?

5. How many school days in the year if school is open 20 da. in January, 18 da. in February, 23 da. in March, 17 da. in April, 21 da. in May, 22 da. in June, 14 da. in September, 21 da. in October, 19 da. in November, and 18 da. in December?

6. Count the number each of desks, seats, tables, chairs, and other articles of furniture there are in your class-room, and then find out how many pieces of furniture the room contains.

7. Take out all of your text-books. Find the total number of pages those books contain.

SIGHT EXERCISE

Add at sight:

1. $7 + 6 + 4 + 3$.
2. $6 + 3 + 1 + 8$.
3. $3 + 2 + 5 + 9 + 4$.
4. $8 + 7 + 3 + 0$.
5. $5 + 7 + 6 + 3 + 8$.

ORAL PROBLEMS

This is the bill of fare of a coffee house:

Tea, coffee, or milk,	5 ct. a glass or cup.
Bread with butter,	5 ct.
Rolls with butter,	5 ct.
Rolls without butter,	2 ct.
Boiled eggs,	8 ct.
Fried eggs,	10 ct.
Cocoa,	8 ct. a cup.

1. What must I pay for a glass of milk and rolls without butter?
2. For a cup of coffee, boiled eggs, and bread with butter?
3. For a cup of tea, fried eggs, and rolls with butter?
4. For a cup of cocoa and rolls with butter?
5. For a glass of milk and boiled eggs?

WRITTEN EXERCISE

Add :

1.	2.	3.	4.	5.
\$ 72.29	\$ 39.92	\$ 46.25	\$ 28.41	\$ 45.22
48.06	48.75	19.68	32.80	31.96
73.92	3.50	17.28	6.50	18.50
<u>8.64</u>	<u>46.25</u>	<u>4.75</u>	<u>46.80</u>	<u>41.33</u>

WRITTEN PROBLEMS

This is the bill of fare of a restaurant :

Soup,	15 ct.
Chops,	35 ct.
Steak,	30 ct.
Roast beef,	25 ct.
Potatoes boiled,	10 ct.
Potatoes fried,	15 ct.
Other vegetables, each	15 ct.
Rice pudding,	10 ct.
Pie,	10 ct.
Tea or coffee,	10 ct.

1. A man ordered for his dinner from this bill of fare a plate of soup, roast beef, fried potatoes, and rice pudding. What did the dinner cost him ?

2. Two friends took their dinner together: one ordered chops, boiled potatoes, pie, and coffee; the other took soup, steak, and tea. The waiter made out one check for the two. What was the amount of the check ?

Review Drills

Add:

1.	2.	3.	4.	5.
7,761	7,328	4,234	3,292	2,145
307	847	6,700	7,074	3,678
2,948	682	8,921	698	8,941
655	356	3,107	8,102	3,427
5,349	9,871	987	2,292	6,835
<u>807</u>	<u>1,789</u>	<u>6,008</u>	<u>3,076</u>	<u>9,857</u>
6.	7.	8.	9.	10.
281	6,498	6,740	2,156	7,141 .
7,439	111	976	7,247	847
6,492	2,947	2,075	9,281	9,756
3,542	783	508	7,648	87
4,108	3,429	9,746	678	2,945
<u>605</u>	<u>158</u>	<u>387</u>	<u>1,094</u>	<u>103</u>

Numbers of Five Orders

Add:

1.	2.	3.	4.	5.
32,241	79,642	40,860	46,835	93,872
56,582	49,426	96,407	79,287	48,964
79,175	98,537	83,755	32,809	92,086
48,036	36,078	48,968	49,631	77,638
24,187	22,963	70,083	78,753	69,079
86,948	41,794	39,410	90,865	83,907
<u>67,277</u>	<u>12,006</u>	<u>82,659</u>	<u>80,707</u>	<u>40,983</u>

Add :

6.	7.	8.	9.	10.
75,308	37,309	42,009	20,919	1,728
9,712	29,367	98,375	83,406	30,691
16,305	40,008	62,403	3,117	53,838
4,273	91,760	75,212	80,097	97,609
892	3,742	36,418	6,305	21,740
92,747	18,209	68,709	29,378	60,909
<u>87,428</u>	<u>25,315</u>	<u>7,080</u>	<u>38,757</u>	<u>74,831</u>

11.	12.	13.	14.	15.
49,308	72,183	68,953	33,846	83,794
64,917	37,325	90,605	46,294	72,813
3,805	82,906	74,215	69,739	29,659
20,009	19,092	2,803	28,399	8,309
33,641	6,583	19,747	74,218	94,778
71,114	92,783	36,588	18,047	76,863
<u>86,002</u>	<u>63,065</u>	<u>29,427</u>	<u>43,819</u>	<u>28,291</u>

16.	17.	18.	19.	20.
76,418	69,427	48,639	13,869	76,695
84,964	38,649	27,358	72,543	82,836
35,318	21,788	19,396	38,397	48,988
27,609	19,932	2,835	55,782	75,767
94,983	46,745	79,602	27,478	83,453
83,448	2,973	84,699	69,925	8,398
76,583	81,405	32,768	89,869	92,272
91,278	17,978	40,835	88,286	67,864
<u>29,364</u>	<u>71,802</u>	<u>54,615</u>	<u>10,759</u>	<u>79,787</u>

Numbers of Six Orders

Add :

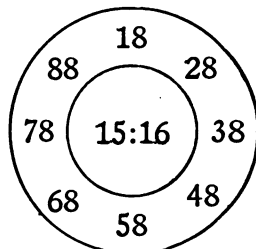
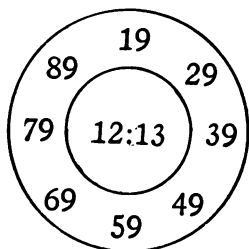
1. 627,630	2. 643,875	3. 196,549
882,652	738,790	887,302
491,845	487,963	368,197
656,564	579,620	673,484
748,029	196,209	569,845
865,793	262,078	970,988
<u>430,976</u>	<u>720,785</u>	<u>793,566</u>
4. 276,381	5. 783,659	6. 342,693
385,902	697,820	814,721
478,698	147,977	936,249
562,110	260,519	278,645
648,972	451,743	384,296
714,924	789,638	576,988
847,676	640,857	848,576
938,498	979,044	717,844
<u>259,764</u>	<u>317,008</u>	<u>398,679</u>
7. 787,989	8. 839,402	9. 937,496
537,275	76,986	472,939
873,746	27,498	861,452
799,967	354,821	371,741
952,695	974,208	836,695
868,277	749,862	987,741
343,627	871,932	368,249
797,578	39,417	509,986
<u>985,289</u>	<u>704,216</u>	<u>818,462</u>

SUBTRACTION

SIGHT EXERCISE

Subtraction Drill by Decades

Subtract at sight:

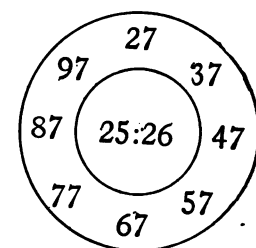
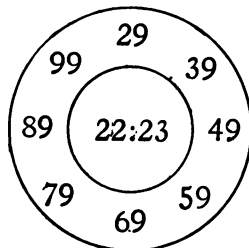


1. Subtract 12 from each number in the outer circle.

3. Subtract 15 from each number in the outer circle.

2. Subtract 13 from each number in the outer circle.

4. Subtract 16 from each number in the outer circle.



5. Subtract 22 from each number.

6. Subtract 25 from each number.

ORAL EXERCISE

Subtract 26 from 49 (say, "49, 29, 23").

Subtract :

1. $\begin{array}{r} 38 \\ \underline{19} \end{array}$	7. $\begin{array}{r} 42 \\ \underline{25} \end{array}$	13. $\begin{array}{r} 94 \\ \underline{65} \end{array}$	19. $\begin{array}{r} 83 \\ \underline{42} \end{array}$
2. $\begin{array}{r} 47 \\ \underline{24} \end{array}$	8. $\begin{array}{r} 79 \\ \underline{32} \end{array}$	14. $\begin{array}{r} 46 \\ \underline{13} \end{array}$	20. $\begin{array}{r} 59 \\ \underline{27} \end{array}$
3. $\begin{array}{r} 69 \\ \underline{28} \end{array}$	9. $\begin{array}{r} 37 \\ \underline{19} \end{array}$	15. $\begin{array}{r} 92 \\ \underline{65} \end{array}$	21. $\begin{array}{r} 41 \\ \underline{16} \end{array}$
4. $\begin{array}{r} 43 \\ \underline{27} \end{array}$	10. $\begin{array}{r} 29 \\ \underline{15} \end{array}$	16. $\begin{array}{r} 30 \\ \underline{18} \end{array}$	22. $\begin{array}{r} 70 \\ \underline{38} \end{array}$
5. $\begin{array}{r} 55 \\ \underline{39} \end{array}$	11. $\begin{array}{r} 58 \\ \underline{39} \end{array}$	17. $\begin{array}{r} 80 \\ \underline{33} \end{array}$	23. $\begin{array}{r} 90 \\ \underline{58} \end{array}$
6. $\begin{array}{r} 75 \\ \underline{47} \end{array}$	12. $\begin{array}{r} 67 \\ \underline{24} \end{array}$	18. $\begin{array}{r} 98 \\ \underline{49} \end{array}$	24. $\begin{array}{r} 79 \\ \underline{28} \end{array}$

ORAL EXERCISE

- | | |
|-------------------|-------------------|
| 1. $38 + 15 = ?$ | 2. $38 - 15 = ?$ |
| 3. $49 + 28 = ?$ | 4. $49 - 28 = ?$ |
| 5. $70 + 35 = ?$ | 6. $70 - 35 = ?$ |
| 7. $83 + 46 = ?$ | 8. $83 - 46 = ?$ |
| 9. $96 + 55 = ?$ | 10. $96 - 55 = ?$ |
| 11. $88 + 29 = ?$ | 12. $88 - 29 = ?$ |

ORAL EXERCISE

Subtract. (Try to do all these examples in less than 6 minutes. Write only the answers.)

1. $\begin{array}{r} 300 \\ 127 \\ \hline \end{array}$	7. $\begin{array}{r} 476 \\ 169 \\ \hline \end{array}$	13. $\begin{array}{r} 938 \\ 713 \\ \hline \end{array}$	19. $\begin{array}{r} 1742 \\ 1209 \\ \hline \end{array}$
2. $\begin{array}{r} 400 \\ 286 \\ \hline \end{array}$	8. $\begin{array}{r} 592 \\ 318 \\ \hline \end{array}$	14. $\begin{array}{r} 827 \\ 602 \\ \hline \end{array}$	20. $\begin{array}{r} 1932 \\ 1360 \\ \hline \end{array}$
3. $\begin{array}{r} 500 \\ 317 \\ \hline \end{array}$	9. $\begin{array}{r} 928 \\ 739 \\ \hline \end{array}$	15. $\begin{array}{r} 3874 \\ 2749 \\ \hline \end{array}$	21. $\begin{array}{r} 6583 \\ 4934 \\ \hline \end{array}$
4. $\begin{array}{r} 320 \\ 164 \\ \hline \end{array}$	10. $\begin{array}{r} 553 \\ 267 \\ \hline \end{array}$	16. $\begin{array}{r} 4291 \\ 3505 \\ \hline \end{array}$	22. $\begin{array}{r} 8612 \\ 2819 \\ \hline \end{array}$
5. $\begin{array}{r} 650 \\ 297 \\ \hline \end{array}$	11. $\begin{array}{r} 802 \\ 597 \\ \hline \end{array}$	17. $\begin{array}{r} 39428 \\ 13706 \\ \hline \end{array}$	23. $\begin{array}{r} 93561 \\ 29315 \\ \hline \end{array}$
6. $\begin{array}{r} 1000 \\ 839 \\ \hline \end{array}$	12. $\begin{array}{r} 1204 \\ 793 \\ \hline \end{array}$	18. $\begin{array}{r} 75273 \\ 39299 \\ \hline \end{array}$	24. $\begin{array}{r} 69473 \\ 51708 \\ \hline \end{array}$

ORAL EXERCISE

- | | |
|--------------------|--------------------|
| 1. $126 + 45 = ?$ | 2. $126 - 45 = ?$ |
| 3. $250 + 75 = ?$ | 4. $250 - 75 = ?$ |
| 5. $300 + 82 = ?$ | 6. $300 - 82 = ?$ |
| 7. $128 - 44 = ?$ | 8. $128 + 44 = ?$ |
| 9. $270 + 46 = ?$ | 10. $270 - 46 = ?$ |
| 11. $525 + 85 = ?$ | 12. $525 - 85 = ?$ |

ORAL EXERCISE

1. $96 - 29 = ?$ $137 - 24 = ?$ $340 - 55 = ?$
2. Minuend 78 86 147 258
 Subtrahend 49 53 99 137
 Remainder ? ? ? ?
3. Find the difference between:
 72 and 27; 49 and 28; 50 and 16;
 36 and 25; 75 and 33; 68 and 47.
4. $34 + ? = 48$; $31 + ? = 56$; $23 + ? = 51$;
 $47 + ? = 93$; $39 + ? = 87$; $38 + ? = 74$.
5. How much greater is:
 47 than 31; 92 than 66; 84 than 24;
 62 than 54; 68 than 39; 95 than 18.

WRITTEN EXERCISE

1. $4729 - 3685 = ?$ $2708 - 1519 = ?$
 $3589 - 1793 = ?$
2. Subtract:
 3284 from 7639; 8515 from 10,000;
 6835 from 9171.
3. Find the difference between:
 27,395 and 48,116; 39,415 and 85,922;
 93,406 and 98,511.
4. How much greater is:
 84,307 than 29,561; 38,129 than 16,509;
 75,400 than 46,984.
5. $64,193 - 58,206 = ?$ $51,939 - 24,716 = ?$
 $92,105 - 74,197 = ?$

ORAL EXERCISE

1. Subtract:

47	64	124	146	245
<u>32</u>	<u>59</u>	<u>78</u>	<u>119</u>	<u>167</u>

2. $35 + ? = 64$; $29 + ? = 81$; $61 + ? = 94$.

3. $74 + 39 = ?$ $74 - 39 = ?$

$66 + 48 = ?$ $66 - 48 = ?$

4. $27 + 30 + 40 - 10 - 30 = ?$

5. $35 + 45 + 10 - 20 - 10 - 16 = ?$

WRITTEN EXERCISE

1. From	948	593	716	805
Take	<u>476</u>	<u>274</u>	<u>309</u>	<u>277</u>

2. Subtract:

515 from 1142; 429 from 938; 276 from 681.

3. Subtract:

\$26.41 from \$38.29; \$15.09 from \$81.72;

\$27.48 from \$55.50.

4. Find the difference between:

1728 in. and 496 in.

3502 bbl. " 2609 bbl.

1475 T. " 1290 T.

5. Subtract:

26,938 from 42,427; 32,511 from 51,749;

64,798 from 100,000.

ORAL PROBLEMS

1. A grocer purchased 200 cans of condensed milk. He sold 165 cans. How many were left?
2. A lady bought goods for \$3.20. How much change did she receive from \$5?
3. One building is 240 ft. high; another building is 150 ft. high. How much higher is the first building than the second?
4. A car has 48 seats. If 16 seats are vacant, how many seats are occupied?
5. A pole was 70 ft. high. It was cut into two pieces. The length of one piece was 45 ft. What was the length of the other piece?

WRITTEN PROBLEMS

1. The population of one village is 476; the population of another village is 935. How many more people are there in the second village than in the first?
2. The distance by rail from New York to Boston is 232 mi. After a train has gone 165 mi., how many more miles must it travel to complete the trip?
3. The total receipts of a store are \$370.62. The total expenses are \$220.80. How much greater are the receipts than the expenses?

4. Before promotion day, a school contained 2000 children. On promotion day, 165 pupils were graduated. How many pupils remained in the school?

5. 145 bu. of grain were taken from a bin containing 400 bu. How many bushels were left in the bin?

ORAL PROBLEMS

1. Minuend	290	460	520	840	900
Subtrahend	180	130	360	685	276
Remainder	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>?</u>

2. Subtract:

136	491	720	835	819
<u>103</u>	<u>274</u>	<u>585</u>	<u>273</u>	<u>426</u>

3. Subtract:

\$7.35	\$4.27	\$8.15	\$5.25	\$10.00
<u>3.50</u>	<u>2.75</u>	<u>7.35</u>	<u>4.50</u>	<u>7.75</u>

4. $23 + ? = 45$; $64 + ? = 100$; $75 + ? = 250$.

5. $65 + 35 = ?$ $65 - 35 = ?$

WRITTEN EXERCISE

1. Subtract:

1298	1475	2934	7426
<u>875</u>	<u>1189</u>	<u>1995</u>	<u>2637</u>

2. Subtract:

73,249	87,306	28,439	96,727
<u>47,198</u>	<u>39,242</u>	<u>26,618</u>	<u>85,125</u>

3. Subtract :

\$30.80	\$146.29	\$32.14	\$750.16
<u>24.75</u>	<u>126.38</u>	<u>24.15</u>	<u>629.74</u>

4. From	1246 lb.	2740 yd.	5280 ft.
Take	1080 lb.	1928 yd.	1390 ft.

5. Minuend	47,208	85,157	26,875
Subtrahend	<u>34,691</u>	<u>73,199</u>	<u>23,491</u>
Remainder	?	?	?

ORAL PROBLEMS

Find the change:

AMOUNT GIVEN	AMOUNT OF PURCHASE
\$ 5.00	\$ 2.20
2.50	2.20
3.75	3.68
10.00	4.75
4.50	4.30
2.00	1.85
5.75	5.60

WRITTEN PROBLEMS

1. Mr. Jones bought the following from Mr. Brown :

Harness	\$240.50
Saddles	100.00
Wagons	560.75
Whips	25.50

Mr. Jones paid Mr. Brown \$750. How much money does he still owe Mr. Brown?

2. A man intends to travel 1200 miles in an automobile.

The first day he travels 228 miles.

The second day he travels 305 miles.

The third day he travels 200 miles.

How many miles has he still to travel?

3. I paid \$225 for a horse and \$65 for a wagon. I sold the horse for \$325 and the wagon for \$100. Find my total gain.

4. A boat has 1250 people on board at the beginning of its trip. At the first landing place, 250 people leave the boat; at the second landing place 426 people leave. How many people are still on the boat?

5. A club needed \$250 to pay for an entertainment.

It obtained \$175 by selling tickets and \$95 by printing advertisements in its programmes. How much did the club have left after the entertainment had been paid for?

ORAL EXERCISE

1. Subtract:

450	260	300	970	480
<u>295</u>	<u>205</u>	<u>175</u>	<u>301</u>	<u>378</u>

2. Subtract:

\$42.00	\$75.00	\$100.00	\$65.00
<u>25.50</u>	<u>37.50</u>	<u>49.25</u>	<u>16.75</u>

3. $38 + ? = 60$ $47 + ? = 70$
 $29 + ? = 80$ $19 + ? = 40$
4. Find the difference between:
86 and 35; 89 and 48; 127 and 99.
5. How much greater is
94 than 81; 76 than 38; 52 than 25.

WRITTEN EXERCISE

1. Subtract:

756	329	528	695
<u>428</u>	<u>256</u>	<u>338</u>	<u>479</u>

2. Subtract:

2563	4718	1593	7521
<u>1939</u>	<u>2697</u>	<u>1269</u>	<u>5741</u>

3. Subtract:

27429	80061	53127	91374
<u>15937</u>	<u>49693</u>	<u>32479</u>	<u>80709</u>

4. From \$14.28 \$39.85 \$83.27 \$42.60
Take 6.09 16.99 51.91 30.08

- 5.
- $3159 + ? = 8141$
- ;
- $19,506 + ? = 35,741$
- .

ORAL PROBLEMS

1. I purchased the following:

Sugar for 27 ct.;
Oatmeal for 32 ct.;
Eggs for 25 ct.

How much change did I receive from \$1.00?

2. A can of milk contained 40 qt. The following were sold from it: 4 qt., 8 qt., 2 qt., 3 qt., and 8 qt. How many quarts were left?

3. The receipts of an office were \$45.

The expenses were:

For rent, \$15.00.

For light, 2.50.

For clerk, 12.00.

How much greater were the receipts than the expenses?

4. A butcher buys 36 turkeys. He sells all except 9 of them. How many are sold?

5. A desk that cost \$39.50 was sold for \$50. Find the profit.

WRITTEN PROBLEMS

1. Hudson discovered the Hudson River in —; Fulton sailed the first steamboat on that river in —. How many years between those two events?

2. Make up a similar problem about Washington and Columbus.

3. Do the same, using Washington and Lincoln.

4. Do the same, using Columbus and Hudson.

5. How many years between 1909 and 1776?

Drill in Subtraction

Numbers of Four Orders

Subtract:

1.	2.	3.	4.	5.	6.
2830	5190	7600	5570	6820	7200
<u>1473</u>	<u>3981</u>	<u>4738</u>	<u>2936</u>	<u>2541</u>	<u>6393</u>

7.	8.	9.	10.	11.	12.
8574	3491	5832	1765	2147	9352
<u>2680</u>	<u>1590</u>	<u>3650</u>	<u>1290</u>	<u>1750</u>	<u>9160</u>

13.	14.	15.	16.	17.	18.
\$35.72	\$16.08	\$56.23	\$83.15	\$66.27	\$37.92
<u>24.18</u>	<u>12.45</u>	<u>36.49</u>	<u>27.38</u>	<u>42.91</u>	<u>22.79</u>

19.	20.	21.	22.	23.	24.
\$97.13	\$41.86	\$59.27	\$35.61	\$74.29	\$19.70
<u>81.17</u>	<u>25.19</u>	<u>18.46</u>	<u>31.29</u>	<u>50.73</u>	<u>15.95</u>

25.	26.	27.	28.	29.	30.
\$74.29	\$36.84	\$15.08	\$25.71	\$62.93	\$81.57
<u>36.83</u>	<u>15.86</u>	<u>12.91</u>	<u>19.30</u>	<u>14.09</u>	<u>20.69</u>

31.	32.	33.	34.	35.	36.
5609	8375	2006	3419	7106	2938
<u>4172</u>	<u>6535</u>	<u>1827</u>	<u>1809</u>	<u>6251</u>	<u>1375</u>

Numbers of Five Orders

Subtract:

1.	2.	3.	4.
35902	76318	42751	8693
<u>26009</u>	<u>47328</u>	<u>15783</u>	<u>5948</u>
5.	6.	7.	8.
64727	35108	92475	16300
<u>52938</u>	<u>26573</u>	<u>49298</u>	<u>12471</u>
9.	10.	11.	12.
39419	72061	31800	42609
<u>35538</u>	<u>49746</u>	<u>21903</u>	<u>15742</u>

Numbers of Six Orders

Subtract:

13.	14.	15.	16.
508347	201690	720396	590460
<u>395841</u>	<u>196211</u>	<u>512641</u>	<u>308769</u>
17.	18.	19.	20.
906315	425009	646321	830095
<u>513061</u>	<u>207396</u>	<u>431891</u>	<u>256728</u>
21.	22.	23.	24.
800726	502903	638502	189000
<u>626430</u>	<u>371938</u>	<u>465852</u>	<u>173628</u>

WRITTEN PROBLEMS

1. A railroad company employs 1528 conductors, 1652 engineers, and 227 gatemen.

How many more conductors are there than gatemen? How many more engineers than gatemen?

2. Two boys took a trip of 58 mi. in a canoe. They went 15 mi. the first day, 13 mi. the second day, 16 mi. the third day, and the balance of the distance on the fourth day. How far did they go on the fourth day?

3. 2750 people went to a circus. 1459 people bought 25-ct. tickets. The remainder bought 50-ct. tickets. How many people bought 50-ct. tickets?

4. The proprietor of a hotel lost \$250 during June; he made a profit of \$350 during July, and of \$1500 during August. What was his total profit for the 3 mo.?

5. A tank contained 750 gallons of water. 465 gallons were drawn off, then 260 gallons were pumped into the tank. How many gallons of water were then in the tank?

6. A real estate company had 536 lots. It sold 379 of them. How many lots were unsold?

7. George received \$10 for his birthday. He spent 50 ct. for a baseball, 25 ct. for a bat, and \$1.25 for a pair of roller skates. He put the remainder into a bank. How much money did he put into the bank?

8. A company manufactures 13,750 boxes of soap. It sells 1000 boxes to one store, 2760 boxes to a second store, 3500 boxes to a third store. How many boxes remain unsold?

9. A train starts from Boston and passes through the following cities:

NAMES OF CITIES	DISTANCE IN MILES FROM BOSTON
Buffalo	481
Niagara Falls	503
Detroit	735
Chicago	1007

How far is it from Buffalo to Detroit? From Niagara Falls to Chicago?

(Make a diagram.)

10. A boat starts from Buffalo and sails to Duluth. It stops at the following places:

NAMES OF CITIES	MILES FROM BUFFALO
Erie	80
Cleveland	180
Detroit	285
Duluth	1115

How far is it from Erie to Duluth? From Cleveland to Detroit? From Detroit to Duluth?

(Make a diagram.)

MULTIPLICATION

Review of Multiplication Tables

Multiplication Table of Twos

Memorize this table :

$2 \times 1 = 2$

$2 \times 5 = 10$

$2 \times 9 = 18$

$2 \times 2 = 4$

$2 \times 6 = 12$

$2 \times 10 = 20$

$2 \times 3 = 6$

$2 \times 7 = 14$

$2 \times 11 = 22$

$2 \times 4 = 8$

$2 \times 8 = 16$

$2 \times 12 = 24$

NOTE TO TEACHER. — See note on page 57, Pupils' Arithmetic, Book I.

Multiplication Table of Threes

Memorize this table :

$3 \times 1 = 3$

$3 \times 5 = 15$

$3 \times 9 = 27$

$3 \times 2 = 6$

$3 \times 6 = 18$

$3 \times 10 = 30$

$3 \times 3 = 9$

$3 \times 7 = 21$

$3 \times 11 = 33$

$3 \times 4 = 12$

$3 \times 8 = 24$

$3 \times 12 = 36$

Multiplication Table of Fours

Memorize this table :

$4 \times 1 = 4$

$4 \times 5 = 20$

$4 \times 9 = 36$

$4 \times 2 = 8$

$4 \times 6 = 24$

$4 \times 10 = 40$

$4 \times 3 = 12$

$4 \times 7 = 28$

$4 \times 11 = 44$

$4 \times 4 = 16$

$4 \times 8 = 32$

$4 \times 12 = 48$

Multiplication Table of Fives

Memorize this table :

$5 \times 1 = 5$

$5 \times 5 = 25$

$5 \times 9 = 45$

$5 \times 2 = 10$

$5 \times 6 = 30$

$5 \times 10 = 50$

$5 \times 3 = 15$

$5 \times 7 = 35$

$5 \times 11 = 55$

$5 \times 4 = 20$

$5 \times 8 = 40$

$5 \times 12 = 60$

Multiplication Table of Sixes

Memorize this table :

$6 \times 1 = 6$

$6 \times 5 = 30$

$6 \times 9 = 54$

$6 \times 2 = 12$

$6 \times 6 = 36$

$6 \times 10 = 60$

$6 \times 3 = 18$

$6 \times 7 = 42$

$6 \times 11 = 66$

$6 \times 4 = 24$

$6 \times 8 = 48$

$6 \times 12 = 72$

Multiplication Table of Sevens

Memorize this table :

$7 \times 1 = 7$

$7 \times 5 = 35$

$7 \times 9 = 63$

$7 \times 2 = 14$

$7 \times 6 = 42$

$7 \times 10 = 70$

$7 \times 3 = 21$

$7 \times 7 = 49$

$7 \times 11 = 77$

$7 \times 4 = 28$

$7 \times 8 = 56$

$7 \times 12 = 84$

Multiplication Table of Eights

Memorize this table:

$8 \times 1 = 8$	$8 \times 5 = 40$	$8 \times 9 = 72$
$8 \times 2 = 16$	$8 \times 6 = 48$	$8 \times 10 = 80$
$8 \times 3 = 24$	$8 \times 7 = 56$	$8 \times 11 = 88$
$8 \times 4 = 32$	$8 \times 8 = 64$	$8 \times 12 = 96$

Multiplication Table of Nines

Memorize this table:

$9 \times 1 = 9$	$9 \times 5 = 45$	$9 \times 9 = 81$
$9 \times 2 = 18$	$9 \times 6 = 54$	$9 \times 10 = 90$
$9 \times 3 = 27$	$9 \times 7 = 63$	$9 \times 11 = 99$
$9 \times 4 = 36$	$9 \times 8 = 72$	$9 \times 12 = 108$

Multiplication Table of Tens

Memorize this table:

$10 \times 1 = 10$	$10 \times 5 = 50$	$10 \times 9 = 90$
$10 \times 2 = 20$	$10 \times 6 = 60$	$10 \times 10 = 100$
$10 \times 3 = 30$	$10 \times 7 = 70$	$10 \times 11 = 110$
$10 \times 4 = 40$	$10 \times 8 = 80$	$10 \times 12 = 120$

Multiplication Table of Elevens

Memorize this table:

$11 \times 1 = 11$	$11 \times 5 = 55$	$11 \times 9 = 99$
$11 \times 2 = 22$	$11 \times 6 = 66$	$11 \times 10 = 110$
$11 \times 3 = 33$	$11 \times 7 = 77$	$11 \times 11 = 121$
$11 \times 4 = 44$	$11 \times 8 = 88$	$11 \times 12 = 132$

Multiplication Table of Twelves

Memorize this table:

$12 \times 1 = 12$	$12 \times 5 = 60$	$12 \times 9 = 108$
$12 \times 2 = 24$	$12 \times 6 = 72$	$12 \times 10 = 120$
$12 \times 3 = 36$	$12 \times 7 = 84$	$12 \times 11 = 132$
$12 \times 4 = 48$	$12 \times 8 = 96$	$12 \times 12 = 144$

$5 \times 12 = 60$ is read, "Five times twelve equals sixty."

In $5 \times 12 = 60$, the number 5 is the multiplier, the number 12 is the multiplicand, the number 60 is the product or answer.

NOTE TO TEACHER. — See p. 56, "Pupils' Arithmetic," Book I.

ORAL EXERCISE

Tell the products:

- | | | |
|---------------------|----------------------|----------------------|
| 1. 4×2 . | 21. 12×3 . | 41. 2×9 . |
| 2. 6×3 . | 22. 3×3 . | 42. 3×11 . |
| 3. 9×5 . | 23. 5×6 . | 43. 12×10 . |
| 4. 8×3 . | 24. 7×8 . | 44. 9×4 . |
| 5. 4×5 . | 25. 10×9 . | 45. 7×2 . |
| 6. 9×9 . | 26. 12×5 . | 46. 2×4 . |
| 7. 11×3 . | 27. 9×6 . | 47. 12×2 . |
| 8. 6×6 . | 28. 7×5 . | 48. 2×12 . |
| 9. 9×10 . | 29. 8×10 . | 49. 10×8 . |
| 10. 4×8 . | 30. 6×11 . | 50. 10×5 . |
| 11. 8×7 . | 31. 12×8 . | 51. 2×7 . |
| 12. 11×6 . | 32. 9×8 . | 52. 12×4 . |
| 13. 6×9 . | 33. 8×8 . | 53. 8×12 . |
| 14. 9×12 . | 34. 4×9 . | 54. 12×6 . |
| 15. 4×11 . | 35. 4×7 . | 55. 12×12 . |
| 16. 8×9 . | 36. 11×4 . | 56. 9×12 . |
| 17. 11×7 . | 37. 10×10 . | 57. 7×11 . |
| 18. 6×12 . | 38. 12×11 . | 58. 11×11 . |
| 19. 7×12 . | 39. 11×12 . | 59. 9×2 . |
| 20. 4×12 . | 40. 9×3 . | 60. 7×9 . |

NOTE TO TEACHER.—The exercises on pages 45–51 are intended for rapid oral drill. The teacher is to state the number of the example; the pupils are to give the answer instantly.

The exercises are valuable also as “busy work” and as aid to the application of the Group System.

ORAL DRILL

Add the products. Tell the sum only:

- | | |
|---------------------------------------|---------------------------------------|
| 1. 5×6 and 2×3 . | 21. 9×7 and 6×8 . |
| 2. 2×5 and 4×3 . | 22. 10×12 and 3×7 . |
| 3. 5×2 and 2×6 . | 23. 8×5 and 4×8 . |
| 4. 3×5 and 5×3 . | 24. 7×8 and 6×5 . |
| 5. 4×2 and 4×3 . | 25. 7×4 and 4×9 . |
| 6. 8×9 and 3×10 . | 26. 8×12 and 12×4 . |
| 7. 5×7 and 2×12 . | 27. 2×7 and 9×3 . |
| 8. 3×9 and 6×6 . | 28. 9×6 and 3×5 . |
| 9. 3×12 and 8×8 . | 29. 9×8 and 4×6 . |
| 10. 8×6 and 6×8 . | 30. 9×12 and 10×0 . |
| 11. 12×6 and 4×8 . | 31. 8×11 and 3×9 . |
| 12. 9×8 and 12×2 . | 32. 10×5 and 4×10 . |
| 13. 6×9 and 9×6 . | 33. 6×9 and 7×8 . |
| 14. 8×5 and 6×11 . | 34. 12×12 and 8×5 . |
| 15. 12×4 and 6×9 . | 35. 8×8 and 6×6 . |
| 16. 9×7 and 4×8 . | 36. 8×3 and 9×5 . |
| 17. 7×4 and 5×9 . | 37. 10×9 and 4×9 . |
| 18. 12×2 and 2×12 . | 38. 4×3 and 12×9 . |
| 19. 5×12 and 11×2 . | 39. 12×7 and 7×6 . |
| 20. 2×12 and 3×6 . | 40. 6×5 and 12×10 . |

ORAL DRILL

Give the missing numbers:

- | | |
|-------------------------|--------------------------|
| 1. $* \times 3 = 6.$ | 26. $* \times 8 = 96.$ |
| 2. $* \times 9 = 36.$ | 27. $* \times 8 = 48.$ |
| 3. $* \times 6 = 36.$ | 28. $* \times 8 = 32.$ |
| 4. $* \times 12 = 36.$ | 29. $* \times 8 = 16.$ |
| 5. $* \times 4 = 36.$ | 30. $* \times 8 = 24.$ |
| 6. $8 \times * = 24.$ | 31. $6 \times * = 54.$ |
| 7. $12 \times * = 24.$ | 32. $12 \times * = 144.$ |
| 8. $2 \times * = 24.$ | 33. $10 \times * = 90.$ |
| 9. $6 \times * = 24.$ | 34. $7 \times * = 56.$ |
| 10. $4 \times * = 24.$ | 35. $9 \times * = 63.$ |
| 11. $* \times 5 = 25.$ | 36. $* \times 4 = 16.$ |
| 12. $* \times 10 = 50.$ | 37. $* \times 6 = 36.$ |
| 13. $* \times 6 = 42.$ | 38. $* \times 8 = 64.$ |
| 14. $* \times 3 = 15.$ | 39. $* \times 7 = 49.$ |
| 15. $* \times 7 = 28.$ | 40. $* \times 9 = 81.$ |
| 16. $7 \times * = 28.$ | 41. $10 \times * = 100.$ |
| 17. $9 \times * = 18.$ | 42. $11 \times * = 132.$ |
| 18. $6 \times * = 18.$ | 43. $7 \times * = 77.$ |
| 19. $2 \times * = 18.$ | 44. $4 \times * = 44.$ |
| 20. $3 \times * = 18.$ | 45. $8 \times * = 96.$ |
| 21. $* \times 4 = 20.$ | 46. $* \times 4 = 28.$ |
| 22. $* \times 2 = 20.$ | 47. $* \times 8 = 56.$ |
| 23. $* \times 5 = 20.$ | 48. $* \times 3 = 9.$ |
| 24. $* \times 6 = 30.$ | 49. $* \times 6 = 18.$ |
| 25. $* \times 12 = 72.$ | 50. $* \times 12 = 36.$ |

ORAL DRILL

What 2 numbers may be multiplied together to give these products:

1. 144.	20. 28.	39. 64.
2. 81.	21. 18.	40. 27.
3. 44.	22. 21.	41. 22.
4. 33.	23. 36.	42. 110.
5. 63.	24. 70.	43. 16.
6. 66.	25. 120.	44. 90.
7. 80.	26. 65.	45. 100.
8. 56.	27. 24.	46. 96.
9. 45.	28. 10.	47. 77.
10. 99.	29. 80.	48. 54.
11. 60.	30. 55.	49. 84.
12. 121.	31. 48.	50. 30.
13. 132.	32. 108.	51. 75.
14. 42.	33. 88.	52. 52.
15. 15.	34. 25.	53. 70.
16. 14.	35. 49.	54. 105.
17. 20.	36. 50.	55. 65.
18. 40.	37. 35.	56. 91.
19. 32.	38. 72.	57. 39.

ORAL EXERCISE

How much are :

1. $(6 \times 5) + (2 \times 5)$. Say:

$$(6 \times 5) + (2 \times 5) = 8 \times 5 = 40,$$

$$\text{or } 8 \times 5 = 40.$$

2. $(3 \times 4) + (2 \times 4)$.

14. $(5 \times 3) + (5 \times 3)$.

3. $(7 \times 4) + (5 \times 4)$.

15. $(8 \times 3) + (2 \times 3)$.

4. $(6 \times 2) + (5 \times 2)$.

16. $(2 \times 9) + (5 \times 9)$.

5. $(4 \times 2) + (8 \times 2)$.

17. $(7 \times 9) + (3 \times 9)$.

6. $(7 \times 6) + (3 \times 6)$.

18. $(6 \times 11) + (5 \times 11)$.

7. $(5 \times 7) + (2 \times 7)$.

19. $(3 \times 11) + (9 \times 11)$.

8. $(6 \times 7) + (4 \times 7)$.

20. $(6 \times 6) + (6 \times 6)$.

9. $(2 \times 7) + (9 \times 7)$.

21. $(2 \times 6) + (8 \times 6)$.

10. $(8 \times 5) + (4 \times 5)$.

22. $(5 \times 8) + (6 \times 8)$.

11. $(3 \times 5) + (9 \times 5)$.

23. $(9 \times 9) + (3 \times 9)$.

12. $(5 \times 2) + (3 \times 2)$.

24. $(3 \times 12) + (7 \times 12)$.

13. $(7 \times 2) + (1 \times 2)$.

25. $(6 \times 5) + (5 \times 5)$.

ORAL EXERCISE

How much are :

1. $(12 \times 8) + (6 \times 5)$.

11. $(12 \times 7) + (11 \times 11)$.

2. $(7 \times 9) + (4 \times 9)$.

12. $(9 \times 3) + (5 \times 8)$.

3. $(11 \times 4) + (7 \times 2)$.

13. $(9 \times 12) + (8 \times 5)$.

4. $(10 \times 9) + (8 \times 6)$.

14. $(8 \times 10) + (4 \times 12)$.

5. $(12 \times 6) + (6 \times 3)$.

15. $(4 \times 9) + (9 \times 8)$.

6. $(8 \times 12) + (2 \times 9)$.

16. $(8 \times 3) + (6 \times 4)$.

7. $(7 \times 2) + (8 \times 7)$.

17. $(6 \times 6) + (9 \times 3)$.

8. $(5 \times 11) + (3 \times 9)$.

18. $(7 \times 8) + (8 \times 7)$.

9. $(6 \times 12) + (9 \times 12)$.

19. $(12 \times 10) + (10 \times 10)$.

10. $(3 \times 8) + (5 \times 7)$.

20. $(12 \times 12) + (8 \times 6)$.

ORAL EXERCISE

Tell the answers :

- 1.
- $(9 \times 2) - (7 \times 2)$
- . Say :

$$(9 \times 2) - (7 \times 2) = 2 \times 2 = 4,$$

$$\text{or } (9 \times 2) - (7 + 2) = 4.$$

- | | |
|--|---------------------------------------|
| 2. $(8 \times 3) - (4 \times 3)$. | 14. $(8 \times 4) - (6 \times 4)$. |
| 3. $(6 \times 5) - (2 \times 5)$. | 15. $(9 \times 7) - (3 \times 7)$. |
| 4. $(7 \times 2) - (3 \times 2)$. | 16. $(6 \times 3) - (3 \times 3)$. |
| 5. $(8 \times 8) - (2 \times 8)$. | 17. $(10 \times 8) - (4 \times 8)$. |
| 6. $(12 \times 4) - (3 \times 4)$. | 18. $(9 \times 6) - (2 \times 6)$. |
| 7. $(9 \times 6) - (4 \times 6)$. | 19. $(8 \times 7) - (5 \times 7)$. |
| 8. $(8 \times 2) - (5 \times 2)$. | 20. $(4 \times 5) - (2 \times 5)$. |
| 9. $(7 \times 9) - (2 \times 9)$. | 21. $(6 \times 6) - (5 \times 6)$. |
| 10. $(12 \times 12) - (3 \times 12)$. | 22. $(8 \times 3) - (7 \times 3)$. |
| 11. $(10 \times 6) - (3 \times 6)$. | 23. $(8 \times 6) - (3 \times 6)$. |
| 12. $(7 \times 5) - (2 \times 5)$. | 24. $(12 \times 5) - (10 \times 5)$. |
| 13. $(12 \times 7) - (6 \times 7)$. | 25. $(9 \times 4) - (6 \times 5)$. |

ORAL EXERCISE

How much are :

- | | |
|--------------------------------------|---|
| 1. $(8 \times 5) - (5 \times 8)$. | 11. $(8 \times 11) - (11 \times 8)$. |
| 2. $(9 \times 7) - (6 \times 7)$. | 12. $(10 \times 8) - (8 \times 10)$. |
| 3. $(6 \times 2) - (2 \times 4)$. | 13. $(6 \times 4) - (4 \times 3)$. |
| 4. $(12 \times 8) - (6 \times 8)$. | 14. $(9 \times 6) - (5 \times 6)$. |
| 5. $(10 \times 7) - (5 \times 7)$. | 15. $(12 \times 4) - (4 \times 8)$. |
| 6. $(12 \times 9) - (9 \times 3)$. | 16. $(12 \times 12) - (11 \times 11)$. |
| 7. $(8 \times 12) - (6 \times 6)$. | 17. $(8 \times 3) - (2 \times 8)$. |
| 8. $(6 \times 9) - (7 \times 5)$. | 18. $(4 \times 7) - (3 \times 8)$. |
| 9. $(9 \times 12) - (8 \times 12)$. | 19. $(8 \times 9) - (7 \times 10)$. |
| 10. $(7 \times 5) - (3 \times 7)$. | 20. $(7 \times 8) - (4 \times 12)$. |

ORAL EXERCISES

1. Which is greater, 2×9 or 2×7 ? How much?
2. $16 \times 3 = 48$. How much is 15×3 ? Why?
3. $3 \times 7 = ?$ How much is 6×7 ? Why?
4. $3 \times 8 = ?$ How much is 6×8 ? Why?
5. How much greater is 4×6 than 4×4 ?
6. How much less is 4×3 than 4×7 ?
7. $4 \times 8 = ?$ How much is 8×8 ?
8. How much greater is 12×5 than 6×5 ?
9. How much greater is 12×5 than 3×5 ?
10. $14 \times 5 = 70$. How much is 15×5 ?
11. $20 \times 5 = 100$. How much is 19×5 ?
12. $6 \times 2 = ?$ How much is 3×2 ?
13. $6 \times 2 = ?$ How much is 2×2 ?
14. $4 \times 6 = ?$ How much is 8×6 ?
15. How much less is 8×3 than 8×6 ?
16. How much less is 9×2 than 9×6 ?
17. How much greater is 10×8 than 10×3 ?
18. How much greater is 11×11 than 11×5 ?
19. $12 \times 2 = ?$ How much is 12×4 ?
20. $12 \times 6 = ?$ How much is 12×12 ?
21. $12 \times 3 = ?$ How much is 12×6 ?
22. $12 \times 4 = ?$ How much is 12×8 ?

ORAL REVIEW — PROBLEMS. MULTIPLICATION TABLES

1. A girl makes 12 bouquets ; each one contains 12 violets. How many violets are used ?

2. William bought 7 firecrackers at 6 ct. each. How much did they cost ?

3. There are 9 books on each shelf. How many books on 7 shelves ?

4. 8 children go for a ride. Each one pays 10 ct. How much is paid by all the children ?

5. If a quart of potatoes costs 8 ct., find the cost of a peck of potatoes.

6. A stairway has 12 steps. Each step is 6 in. high. How high is the flight of stairs ?

7. There are 6 rows of children. Each row contains 7 children. How many children in all ?

8. One gas jet burns 5 *cu. ft.* of gas each hour. How much gas is burned by 8 gas jets at that rate ?

9. A family spends 5 ct. a day for ice. Find the cost for a week.

10. If there are 8 panes of glass in each window, how many panes are there in 9 windows ?

11. Find the cost of 8 yd. of muslin at 8 ct. a yard.

12. At 12 ct. a pound, find the cost of 3 lb. of cheese.

13. A house has 6 stories. There are 8 windows in each story. How many windows in the house?

14. A box will hold 8 eggs. How many eggs can be put into 12 boxes of that size?

15. A road is 12 yd. wide. How many feet in the width?

16. If a train travels 9 mi. an hour, how far will it travel in 5 hr.? In 9 hr.?

17. A pointer is 3 ft. long. How many inches in the length?

18. At 9 ct. a quart, find the cost of a gallon of vinegar.

19. How many feet of wire in 9 yd.?

20. A quart of milk costs \$.08. How much does a gallon cost?

21. A pint of milk costs \$.04. How much do 2 qt. cost?

22. Find the cost of the 2-ct. stamps for 12 city letters.

23. There are 7 columns in each page of a newspaper. The paper contains 8 pages. How many columns in the paper?

24. How many hoofs have 4 horses? 6 horses? 12 horses?

25. If a yard of ribbon costs 6 ct., find the cost of 6 yd.; of 8 yd.; of 12 yd.

26. A bag of salt weighs 3 lb. How much do 7 bags weigh? 12 bags?

27. How many days in 8 wk.? In 4 wk.? In 12 wk.? In 6 wk.?

28. At 6 ct. each, what is the cost of 9 eggs? Of 5 eggs? Of 7 eggs? Of 10 eggs?

29. How many quarts in 4 pk. of potatoes? In 8 pk.? In 12 pk.?

30. At 12 ct. a pound, find the cost of 3 lb. of beef; of 7 lb.; of 11 lb.

31. A horse runs 3 mi. an hour. How far will it run in 2 hr.? In 4 hr.? In 5 hr.? In 9 hr.?

32. How many quarts in 8 gal. of water? In 10 gal.? In 12 gal.?

33. I bought 6 books at 12 ct. each. How much money is left from \$1?

34. Nellie had 25 ct. She bought 24 jacks at the rate of 6 for 5 ct. How much change did she receive?

35. George measures the length of a window with a ruler which is 2 ft. long. The length of the window is 3 times the length of the ruler. How long is the window?

36. Then George measures the height of the blackboard with the 2-ft. ruler. He finds that he must measure 4 times. How high is the blackboard?

37. Finally George measures the length of the room with the 2-ft. ruler. He finds that after he has measured 12 times there is 1 ft. left over. How long is the room?

38. Mary is 8 yr. old. Her mother is 4 times as old. How old is Mary's mother?

39. Tom had 7 marbles. Dick had 6 times as many. How many marbles had the two boys? (*Use direct method of solution.*)

40. One man rides 20 blocks. Another man rides 6 times as far. How far does the second man ride?

41. A boy paid 5 ct. for a soda and 6 times as much for candy. How much did he spend? (*Use direct method of solution.*)

42. 6 boys rode to a baseball game. The fare to the grounds was 5 ct. each. How much did the boys pay?

43. While at the game each of the boys bought a score card for 3 ct. How much did the cards cost?

44. Make up 2 more examples about the 6 boys.

45. Charles wanted to buy 4 packages of fire-crackers at 5 ct. each. His father gave him the money. How much money did Charles receive?

46. A lady rides in a subway train every morning and every night, for 6 days. How many tickets does she buy? How much do they cost, if each ticket costs 5 ct.?

47. Sidney wants to buy 6 penholders and 6 pens. The penholders cost 5 ct. each. The pens cost 1 ct. each. How much will Sidney have to pay for all? How much change will he receive from 50 ct.?

48. How much will 6 qt. of milk cost at 3 ct. a pint?

49. How many inches in a stick 6 ft. long?

50. A man receives \$2 a day. How much does he receive for working 6 da.?

51. Black ink costs 5 ct. a bottle. Red ink costs 10 ct. a bottle. How much more must I pay for 6 bottles of red ink than for 6 bottles of black ink? (*Use direct method.*)

52. Harry bought 8 marbles for 2 ct. each and 12 marbles for 3 ct. each. How much money did he spend?

53. On one shelf there were 9 piles of books; each pile contained 12 books. On another shelf there were 8 piles of books; each pile contained 9 books. How many more books were there on the first shelf than on the second shelf?

54. William bought 10 packs of firecrackers for 6 ct. each. George bought only 5 packs of firecrackers at 6 cents each. How much more money did William spend than George?

55. Mary bought 8 eggs for 3 ct. each. The storekeeper gave her 6 ct. change. How much money did Mary have before she paid for the eggs?

56. A grocer has 2 kinds of butter. One kind costs 40 ct. a pound, the other 36 ct. a pound. How much more money must be spent for 12 lb. of the first kind than for 12 lb. of the second kind?

57. It required 8 strips of wall paper to paper one wall of a room. It required 5 strips of paper for a second wall of the room. How much longer is the first wall than the second, if each strip of paper is 2 ft. wide?

58. A grocer buys oranges for 2 ct. each. He sells them for 5 ct. each. How much profit does he make on 3 doz. oranges?

59. At the rate of 3 blocks in 2 min., how long will it take a boy to skate 12 blocks? 21 blocks? 36 blocks?

60. A boy skates 3 blocks in 2 min. How far will he skate in 6 min.? In 10 min.? In 20 min.?

61. At the rate of 11 mi. in 2 hr., how far will a horse go in 6 hr.? In 8 hr.? In 12 hr.?

62. I bought 9 chairs for \$10. How many could I buy at that rate for \$30? For \$40? For \$80?

63. I bought 9 chairs for \$ 10. How much would 18 chairs cost at that rate? 27 chairs? 45 chairs?

64. Find the cost of 2 doz. marbles at the rate of 3 marbles for 2 ct.

65. A man earns \$ 27 a week. He spends \$ 21 a week. How much does he save in 5 wk. at that rate? In 9 wk.? In 10 wk.? (*Use direct method of solution.*)

66. How many half-pint jars are needed for 4 qt. of jelly?

67. I pay 2 ct. for a newspaper each morning, for 6 da.; the Sunday paper costs 5 ct. How much do I spend each week for papers?

68. How many pint bottles can be filled from a keg containing a gallon of cider?

Prices in a Stationery Store

Lead pencils, 3 ct. each.

Erasers, 4 ct. each.

Black ink, 5 ct. a bottle.

Red ink, 8 ct. a bottle.

Rubber bands, 2 ct. a dozen.

Book straps, 12 ct. each.

69. Find the cost of 3 lead pencils; of 6 pencils; of 9 pencils; of 12 pencils.

70. Find the cost of 2 erasers; of 4 erasers; of 8 erasers; of 12 erasers.

71. Find the cost of 2 bottles of black ink and 3 bottles of red ink.

72. Find the cost of 6 erasers, 3 lead pencils, and 2 bottles of black ink.

73. Find the cost of 3 doz. rubber bands, 2 book straps, and a bottle of black ink ?

74. Find the cost of 2 lead pencils, 3 erasers, 2 bottles of black ink, and 4 doz. rubber bands.

75. Make 2 more problems about the lead pencils. Solve them.

76. Make 3 more problems about the erasers. Solve them.

77. Make 2 more problems about the black ink. Solve them.

78. A farm contains :

7 rows of peach trees, with 12 trees in each row ;

9 rows of apple trees, with 7 trees in each row ;

6 rows of strawberry vines, with 9 vines in each row ;

12 rows of berry bushes, with 12 bushes in each row.

Find how many peach trees.

Find how many apple trees.

Find how many strawberry vines.

Find how many berry bushes.

79. A farmer sells:

8 heads of cabbage at 8 ct. each;

12 qt. of potatoes at 9 ct. each;

8 qt. of berries at 6 ct. each;

10 doz. radishes at 4 ct. a dozen.

Make 6 problems from these items. Solve each problem.

80. Fill the blank spaces with numbers less than 13:

—— qt. milk, at —— a quart.

—— doz. eggs, at —— a dozen.

—— lb. crackers, at —— a pound.

—— cans condensed milk, at —— a can.

Make 4 problems. Solve each problem.

Multiplication : Forms of Explanation or Analysis

A. 4 boys have 52 marbles each. How many marbles have all the boys?

EXPLANATION OR FORM OF ANALYSIS. 4 boys have 4 times as many marbles as 1 boy.

Therefore 4 boys have 4×52 marbles, or 208 marbles.

B. A cap cost 60 cents. How much do 9 caps cost?

EXPLANATION OR FORM OF ANALYSIS. 9 caps cost 9 times as much as 1 cap.

Therefore 9 caps cost 9×60 cents, or \$5.40.

C. A boat sails 13 miles in an hour. How many miles does it sail in 6 hours?

EXPLANATION OR FORM OF ANALYSIS. The distance sailed in 6 hours is 6 times the distance sailed in 1 hour.

Therefore the distance is 6×13 miles, or 78 miles.

D. A family spends \$28 each month for rent. How much rent is paid in 10 months?

EXPLANATION OR FORM OF ANALYSIS. The rent for 10 months is 10 times the rent for 1 month.

Therefore the rent for 10 months is $10 \times \$28$, or \$280.

E. If 2 cans of corn cost 25 cents, how much do 4 cans cost?

EXPLANATION OR FORM OF ANALYSIS. 4 cans cost twice as much as 2 cans.

Therefore 4 cans cost 2×25 cents, or 50 cents.

F. A storekeeper buys picture post cards for 3 cents each. He sells them for 5 cents each. Find the profit on 48 cards.

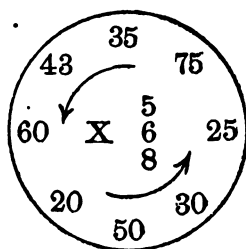
EXPLANATION OR FORM OF ANALYSIS. The profit on 48 cards is 48 times the profit on 1 card.

Therefore the profit is 48×2 cents, or 96 cents.

NOTE TO TEACHER. — These Forms of Analysis are given as suggestions. Any form that is definite and logical should be accepted. Forms of Analysis should not be memorized nor recited verbatim.

Multiplier of One Order**WRITTEN PROBLEMS**

1. At 36 ct. a box, what is the cost of 9 boxes of crayons?
2. A man walks 14 mi. in 1 da. At that rate, how far could he walk in 8 da.?
3. If there are 72 pens in each box, how many pens are there in 9 boxes?
4. Apples were bought at 9 ct. a quart. They were sold at 15 ct. a quart. Find the profit on 27 qt. (*Use direct method of solution.*)

ORAL EXERCISE

Multiply each number on the circumference by 5; then by 6; then by 8. Tell the products only.

ORAL PROBLEMS

1. 3 boxes contain 21 pencils each. How many pencils in the 3 boxes?
2. There are 25 baskets. Each basket contains 6 pk. of nuts. How many pecks in all the baskets?

3. At 32 ct. each, what is the cost of 9 pointers?
4. A book has 80 leaves. How many leaves in 9 books of that size?
5. 3 bundles of wood cost 14 ct. Find the cost of 12 bundles at that rate.

WRITTEN EXERCISE

1. $88 \times 6 = ?$ $88 \times 8 = ?$ $88 \times 9 = ?$ $88 \times 12 = ?$
2. $37 \times 6 = ?$ $37 \times 7 = ?$ $37 \times 8 = ?$ $37 \times 9 = ?$
3. Multiply 87 by 4, by 5, by 6, by 7, by 8.
4. Multiply 86 ct. by 8, by 7, by 6, by 5, by 4.
5. What products are obtained by multiplying \$44 by 6? 68 boxes by 7? 83 by 9?

WRITTEN PROBLEMS

1. At 25 ct. a peck, find the cost of 9 pk. of peas.
2. There are 72 bottles of ink in each box. How many bottles are there in 12 boxes?
3. At \$45 each, find the cost of 9 bicycles.
4. One tree is 6 ft. tall. Another tree is 14 times as tall. How high is the second tree?
5. One farmer has 36 chickens. A second farmer has 3 times as many; a third farmer has 5 times as many as the first farmer. How many chickens have the three farmers? (*Use direct method of solution.*)

ORAL EXERCISE

- | | | |
|----------------------------------|-------------------------------|-------------------------------|
| 1. $9 \times 30 = ?$ | $9 \times 35 = ?$ | $9 \times 40 = ?$ |
| 2. $4 \times 12 \text{ ct.} = ?$ | $4 \times 24 \text{ ct.} = ?$ | $4 \times 36 \text{ ct.} = ?$ |
| 3. $6 \times 23 = ?$ | $6 \times 33 = ?$ | $6 \times 43 = ?$ |
| 4. $8 \times \$90 = ?$ | $8 \times \$80 = ?$ | $8 \times \$70 = ?$ |
| 5. $7 \times 32 = ?$ | $7 \times 42 = ?$ | $7 \times 52 = ?$ |

ORAL PROBLEMS

1. If a ton of coal costs \$6, how much will 45 T. cost?
2. A trolley car makes 8 trips a day. On each trip it carries 56 passengers. How many passengers are carried on 8 trips?
3. A boy receives \$4 a week. How much does he receive in 47 wk. at that rate?
4. If 2 chairs cost \$36, find the cost of 1 doz. chairs at that rate.
5. 3 chairs cost \$22. Find the cost of 6 chairs at that rate; of 9 chairs; of 12 chairs.

WRITTEN EXERCISE

Find the products of:

1. 47×9 ; 86×8 ; 49×4 ; 79×5 ; 96×7 .
2. $7 \times 83 \text{ ct.}$; $11 \times 44 \text{ ct.}$; $10 \times 49 \text{ ct.}$; 85×12 ; $9 \times 65 \text{ ct.}$
3. 29×8 ; 45×6 ; 54×9 ; 77×7 ; 93×9 .
4. Multiply \$96 by 6, by 4, by 7, by 9, by 8.
5. Multiply 38 by 9, by 6, by 3, by 8, by 4.

WRITTEN PROBLEMS

1. How much do 6 cows cost at \$39 each?
2. There are 54 children on register in each of 6 classes. How many children on register in all?
3. I intended to buy 7 chairs at \$22 each. I found they were reduced to \$15 each. How much money did I save by buying 7 chairs at the reduced price?
4. At \$46 each, find the cost of 8 pictures.
5. 3 tables cost \$83. At that rate, how much will 9 tables cost? 12 tables? 18 tables?

ORAL PROBLEMS

1. If each package of flour weighs 2 lb., how much will 450 packages weigh?
2. I bought 6 yd. of lace at \$1.25 a yard. Find the cost.
3. A factory makes 750 hats a week. How many hats are made in 7 wk. at that rate?
4. A farmer has 3 fields. Each field yields 260 bu. of wheat. What is the entire crop?
5. A butcher sells 230 lb. of meat in 4 da. At that rate, how many pounds will he sell in 8 da.? In 16 da.?

WRITTEN EXERCISE

$$\begin{array}{lll} 1. \quad 789 \times 3 = ? & 896 \times 6 = ? & 864 \times 8 = ? \\ & 964 \times 2 = ? & 473 \times 5 = ? & 476 \times 7 = ? \end{array}$$

2. Multiply 786 by 4, by 6, by 8, by 9, by 3.

3. Multiply :

$$\begin{array}{r} \$695 \\ \underline{6} \end{array} \quad \begin{array}{r} \$743 \\ \underline{4} \end{array} \quad \begin{array}{r} \$8.19 \\ \underline{8} \end{array} \quad \begin{array}{r} \$2.67 \\ \underline{2} \end{array} \quad \begin{array}{r} \$439 \\ \underline{9} \end{array}$$

4. Multiply :

$$\begin{array}{r} 218 \text{ horses} \\ \underline{6} \end{array} \quad \begin{array}{r} 395 \text{ cows} \\ \underline{7} \end{array} \quad \begin{array}{r} 618 \text{ sheep} \\ \underline{4} \end{array} \quad \begin{array}{r} 950 \text{ chickens} \\ \underline{8} \end{array} \quad \begin{array}{r} \$9.45 \\ \underline{3} \end{array}$$

5. Multiply :

$$\begin{array}{r} 725 \\ \underline{9} \end{array} \quad \begin{array}{r} 826 \\ \underline{8} \end{array} \quad \begin{array}{r} 721 \\ \underline{7} \end{array} \quad \begin{array}{r} 318 \\ \underline{9} \end{array} \quad \begin{array}{r} 647 \\ \underline{8} \end{array}$$

WRITTEN PROBLEMS

Mr. Smith's Farm

1. Mr. Smith had a farm. The first year he raised 139 bu. of potatoes. The second year he raised 5 times as many potatoes. How many did he raise in both years?

2. The first year he obtained 378 qt. of cherries; the second year 3 times as many cherries. How many quarts of cherries were obtained the second year?

3. The first year his apple trees gave him 684 bu. of apples; the second year twice as many. How many apples did he get in both years?

4. He had 126 peach trees. Each tree yielded 7 qt. of peaches. How many quarts of peaches were obtained from the 7 trees?

5. He sold 198 crates of berries. Each crate contained 8 qt. How many quarts of berries did he sell?

ORAL EXERCISE

1. Multiply the following numbers by 9:

120; 213; 432; 321; 540.

2. Multiply the following by 8:

\$430; \$6.12; \$9.10; \$740; \$325.

3. Multiply the following numbers by 5:

250; 256; 340; 345; 810.

4. Multiply the following by 7:

212 lb.; 709 ft.; 310 yd.; 506 in.; 811 sq. ft.

5. Multiply the following numbers by 6:

315; 250; 330; 140; 720.

ORAL PROBLEMS

1. A cow gave *an average of* 8 qt. of milk each morning for 120 mornings. How many quarts did she give in all?

2. A boat brought in 325 lb. of fish each week for 9 wk. How many pounds in all?

3. A barrel of flour weighs 196 lb. Find the weight of 3 bbl.; of 5 bbl.; of 8 bbl.

4. If a railroad reduces the fare from 3 ct. a mile to 2 ct. a mile, how much is saved in going the following distances: 225 mi.; 430 mi.; 216 mi.; 64 mi.? (*Use direct method of solution.*)

5. A farmer obtains 109 eggs in 3 da. At that rate, how many eggs will be obtained in 12 da.? In 15 da.? In 18 da.?

WRITTEN EXERCISE

1. Multiply:

367	974	896	479	382
<u>5</u>	<u>8</u>	<u>7</u>	<u>9</u>	<u>4</u>

2. Multiply:

\$4.78	\$8.50	\$5.06	\$7.09	\$8.03
<u>5</u>	<u>7</u>	<u>6</u>	<u>8</u>	<u>9</u>

3. Multiply:

694 men	705 books	803 peaches	629 marbles
<u>5</u>	<u>4</u>	<u>7</u>	<u>2</u>

4. $6 \times 508 = ?$	$4 \times 508 = ?$	$9 \times 607 = ?$
$7 \times 903 = ?$	$3 \times 607 = ?$	$6 \times 502 = ?$

5. $9 \times 701 = ?$	$6 \times 804 = ?$	$4 \times 207 = ?$
$6 \times 907 = ?$	$8 \times 605 = ?$	$5 \times 809 = ?$

WRITTEN PROBLEMS

1. A builder intends to build 8 houses. Each house requires 854 ft. of lumber for the floors. How much lumber will he need for the floors of the 8 houses?

2. A ticket agent sells 374 tickets a day. At that rate, how many tickets will he sell in 5 da.?

3. A factory uses 698 lb. of lead a day. How many pounds will be needed in 6 da. at that rate?

4. There are 3 schools near one another in New York. Each school has 978 children on register. How many children are in the 3 schools?

5. A newspaper publisher uses 426 rolls of paper in 3 da. At that rate, how many rolls of paper will be used in 12 da.? In 21 da.? In 27 da.?

ORAL EXERCISE

1. How much is:

206×6 ? 321×7 ? 430×2 ? 560×5 ? 335×2 ?

2. Multiply 516 by 2, by 4, by 3, by 9, by 7.

3. Find the products:

Multiplicand	\$ 690	\$ 265	\$ 2.54	\$ 8.30	970
Multiplier	<u>8</u>	<u>7</u>	<u>6</u>	<u>4</u>	<u>8</u>

4. Multiply the following pairs of numbers together: 260 and 3; 840 and 5; 720 and 6; 313 and 3; 220 and 8.

5. 6×150 girls = ? 6×330 pencils = ?

ORAL PROBLEMS

1. An apple tree yields 130 apples. At that rate, how many apples will be obtained from 9 trees?
2. A shoe factory employs 250 men. Each man makes 6 pairs of shoes a day. How many pairs are made by all in 1 da.? How many shoes?
3. A furnace burns 4 T. of coal a month. How many tons will be consumed in 3 yr.?
4. A large stable has 115 horses on each floor. There are 4 floors. How many horses in the stable?
5. 3 men can make 130 suits in 2 wk. At that rate, how many suits can 9 men make in 2 wk.?

WRITTEN EXERCISE

1. Multiplicand \$648 \$3.74 \$4.63 \$287 501
 Multiplier $\frac{9}{?}$ $\frac{6}{?}$ $\frac{4}{?}$ $\frac{8}{?}$ $\frac{9}{?}$
 Product

2. Find the products of:
 418 and 5; 836 and 7; 596 and 9; 739 and 6.

3. Multiply:

706 pens	935 skates	209 shoes	608 boxes
<u>8</u>	<u>9</u>	<u>4</u>	<u>6</u>

4. Find the products of:
 865 and 4; 938 and 3; 735 and 6; 908 and 9.

WRITTEN PROBLEMS

1. A toy factory made the following toys in 1 wk.:

385 Teddy bears;	974 dolls;
227 lions;	856 horses.

At that rate, how many Teddy bears would be made in 7 wk.? How many lions? How many dolls? How many horses? How many toys in all?

2. A railroad charges 3 ct. a mile for fare. Find the cost of tickets for each of the following distances: 234 mi.; 637 mi.; 896 mi.; 768 mi.

3. A grocer orders the following:

3 boxes of oranges, weighing 124 lb. each;
7 bbl. of flour, weighing 196 lb. each;
6 bbl. of apples, weighing 225 lb. each;
4 bbl. sugar, weighing 256 lb. each.

Find the weight of the oranges; of the flour; of the apples; of the sugar. Find the entire weight of the goods he ordered.

4. A horse weighs 857 lb. How much will 18 horses weigh at that rate?

5. The distance from A to B is 368 mi. The distance from B to C is 4 times as great. What is the entire distance from A to C ?

A ————— B ————— C
368 miles

ORAL PROBLEMS

1. 8 cakes of ice weigh 120 lb. each. What is the total weight?
2. A railroad charges 5 ct. for a trip. How much do 120 trips cost? 200 trips? 320 trips? 350 trips? 250 trips?
3. What is the weight of 260 cans of chocolate if each can weighs five pounds?
4. How many days are there in 110 wk.? In 215 wk.? In 320 wk.?
5. A man saves \$350 in 2 yr. At that rate, how much will he save in 6 yr.? In 8 yr.?

WRITTEN PROBLEMS

1. How many pints in 210 pk.?
2. There are 6 boxes, each one containing 144 lead pencils. How many pencils in all?
3. A school building consists of four floors. On each floor there are 340 children. How many children are there in the building?
4. In a school of 855 children each child uses the following articles during a term:
 - 4 writing pencils;
 - 3 drawing pencils;
 - 5 pads of paper;How many writing pencils are used?
How many drawing pencils are used?
How many pads of paper are used?

5. Make two problems similar to No. 4. Solve each problem.

6. One farmer raised 240 bu. of potatoes; another raised 5 times as many. How many bushels did both raise?

7. A railroad has 9 mail cars. Each one carries 117 bags of mail. How many bags are carried by the railroad?

8. A department store employs 3 times as many people during Christmas week as it employs during the summer months. In the summer it employs 428 people. How many are employed during Christmas week?

9. The height of a building is 7 times the height of the flagstaff. The flagstaff is 104 ft. high. How high is the building?

10. A storekeeper sold the following on one day:

284 loaves of bread;
134 lb. of cake;
83 packages of crackers.

How many loaves of bread will he sell in 6 da. at that rate? How many pounds of cake will he sell in 6 days? How many packages of crackers will he sell in 6 days?

11. The price of meat was 16 ct. a pound. It has been raised to 22 ct. a pound. What is the increase in cost to a merchant who buys 764 lb.?

To multiply by 10

A short way to multiply by 10 is to annex 0 to the multiplicand, e.g. $10 \times 56 = 560$; $10 \times 748 = 7480$.

Multiply \$ 3.25 by 10.

$$\begin{aligned} \$3.25 &= 325 \text{ cents.} & 10 \times 325 \text{ cents} &= 3250 \text{ cents.} \\ & & 3250 \text{ cents} &= \$32.50. \end{aligned}$$

To multiply a number containing dollars and cents by 10, annex 0 to the multiplicand and move the decimal point one place to the right, e.g. $10 \times \$7.48 = \74.80 ; $10 \times \$276.18 = \$2,761.80$.

To multiply by 20, 30, 40, etc. to 90

To multiply by 20, 30, 40, etc., arrange the example in this way :

$$\begin{array}{r} 60 \\ 30 \\ \hline 1800 \end{array} \qquad \begin{array}{r} 97 \\ 80 \\ \hline 7760 \end{array}$$

Multiplier of Two Orders**EXERCISE****1. Multiply :**

95 by 20, by 40, by 60, by 80, by 90.

64 by 10, by 20, by 30, by 40, by 60.

127 by 10, by 20, by 40, by 50, by 80.

360 by 10, by 30, by 50, by 70, by 90.

2. Multiply :

36 ct.	72 ct.	\$1.08	\$1.44	\$1.80
<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>

$$\begin{array}{lll} 3. \quad 79 \times 81 = ? & 103 \times 16 = ? & 438 \times 29 = ? \\ 573 \times 46 = ? & 973 \times 83 = ? & 574 \times 34 = ? \end{array}$$

$$\begin{array}{ll} 4. \quad 79 \text{ times } \$432 = ? & 85 \text{ times } 650 \text{ ft.} = ? \\ 29 \times 308 \text{ qt.} = ? & 42 \text{ times } 605 \text{ men} = ? \end{array}$$

5. Multiply:

$$\begin{array}{r} 476 \\ \underline{73} \end{array} \quad \begin{array}{r} 907 \\ \underline{40} \end{array} \quad \begin{array}{r} 430 \\ \underline{93} \end{array} \quad \begin{array}{r} 761 \\ \underline{86} \end{array} \quad \begin{array}{r} 805 \\ \underline{73} \end{array}$$

$$\begin{array}{lll} 6. \quad 35 \times 843 = ? & 70 \times 936 = ? & 29 \times 807 = ? \\ 46 \times 375 = ? & 87 \times 109 = ? & 27 \times 356 = ? \end{array}$$

$$\begin{array}{ll} 7. \quad 74 \times 508 \text{ shoes} = ? & 86 \times 473 \text{ trees} = ? \\ 56 \times 942 \text{ horses} = ? & 27 \times \$650 = ? \\ 38 \times \$9.45 = ? & 34 \times \$750 = ? \end{array}$$

WRITTEN PROBLEMS

1. One orchard produces 27 bbl. of apples; another orchard produces 38 times as many apples. How many barrels of apples are produced by the second orchard?

2. A firm employs 63 men. Each man receives a salary of \$37 a week. How much money do the 63 men receive in a week? (*Prove the answer.*)

3. A firm employs 74 men. Each man receives a salary of \$28 a week. How much do all the men receive for working for 2 wk.? For 3 wk.?

4. A factory uses 69 T. of coal a month. How many tons will be required for 19 mo. at that rate? How much will the coal cost at \$5 a ton? (*Prove the answer.*)

5. A boat makes 8 trips a day. It carries 44 passengers each trip. At that rate, how many passengers will it carry in 9 da.? (*Prove the answer.*)

6. A company has 4 stores. The first store sells 32 lamps at \$18 each. The second store sells 24 lamps at \$18 each. The third store sells 29 lamps at \$18 each. The fourth store sells 15 lamps at \$18 each. What is the total amount of money received by the 4 stores?

7. One orchard produces 35 bbl. of apples; another orchard produces 22 times as many apples. How many barrels of apples are produced in both orchards?

8. How much will 7 doz. umbrellas cost at \$2.75 each?

9. 24 boxes of tomatoes are bought for \$5.50. They are sold for 28 ct. a box. How much is the profit? (*Prove the answer.*)

10. It costs a manufacturer \$1.37 to make a pair of shoes. He sells them for \$2.45 a pair. Find the profit on 6 doz. pairs of shoes.

11. A builder bought the following: 24 doors at \$5.75 each; 36 shutters at \$3.40 each; 60 pr. of hinges at 34 ct. a pair. How much is paid for the doors? For the shutters? For the hinges? How much is paid for all?

12. Make 2 similar examples from these prices quoted in problem 11.

13. In the morning a man sells 7 pr. of rubbers for 85 ct. a pair; in the afternoon he sells 9 pr. at 85 ct. a pair. How much money is received during the day?

14. Find the cost of 12 doz. ink wells at 39 ct. each.

15. It requires 72 ft. of board to fence a lot. How many feet are required to fence 17 lots of the same size?

16. A lady bought 26 yd. of ribbon at 15 ct. a yard. How much change should she receive from \$5? (*Prove the answer.*)

17. A train consists of 9 cars. Each car contains 34 boxes of oranges. How much are all the oranges worth at 40 ct. a box? (*Prove the answer.*)

18. There are 57 classes in a school. Each class has an average of 42 pupils. How many pupils are in the school?

19. A man pays \$44 a month for rent. How much rent does he pay in 3 yr.? (*Prove the answer.*)

20. A sewing machine costs \$65. Find the cost of 11 doz. machines.

21. A tub of butter contains 45 lb. How much will be received if the butter is sold at 36 ct. a pound? (*Prove the answer.*)

22. How much will be received for 7 tubs of butter, of 45 lb. each, if the butter is sold at 35 ct. a pound?

23. A sum of money was divided among 18 persons. Each person received \$59. What was the sum of money?

24. Find the cost of 94 bbl. of flour at \$6.75 a barrel.

25. A barrel of flour is bought for \$6.50. It contains 196 lb. How much profit is made by selling the flour for 5 ct. a pound? (*Prove the answer.*)

26. There are 23 rooms in a building. Each room has 8 electric-light bulbs. Find the cost of the bulbs at 16 ct. each. (*Prove the answer.*)

27. An entertainment is given for 6 nights. The tickets cost 50 ct. for each performance. There are 580 people at the entertainment each night. How much money is received for the tickets?

28. There are 24 families in a tenement house. They pay *an average of* \$16 a month for rent. How much rent is received from all the families in 2 yr.?

To multiply by 100

To multiply by 100, annex 00 to the multiplicand.

$$\begin{array}{r} 347 \\ 100 \\ \hline 34700 \end{array} \qquad \begin{array}{r} 9768 \\ 100 \\ \hline 976800 \end{array}$$

To multiply by 200, 300, etc.

To multiply by 200, 300, etc., arrange the example in this way :

$$\begin{array}{r} 70 \\ 400 \\ \hline 28000 \end{array} \qquad \begin{array}{r} 595 \\ 900 \\ \hline 535500 \end{array}$$

To multiply Dollars and Cents by 100, 200, etc.

Multiply \$35.50 by 100.

$$\begin{array}{r} \$35.50 \\ 100 \\ \hline \$3550.00 \end{array} \quad \begin{array}{l} \text{Move the decimal point 2 places to the} \\ \text{right. } 100 \times \$74.65 = \$7465. \end{array}$$

Multiply \$35.50 by 200, 300, etc.

$$\begin{array}{r} \$35.50 \\ 200 \\ \hline \$7100.00 \end{array} \quad \begin{array}{l} \text{Move the decimal point 2 places to the} \\ \text{right; then multiply by 2, 3, etc.} \\ 200 \times \$27.53 = \$5506. \\ 800 \times \$75.60 = \$60480. \end{array}$$

Omit all naughts to the right of the decimal point in the answer.

To multiply by 1000 2000, 3000, etc.

To multiply by 1000 annex 000 to the multiplicand; to multiply by 2000, multiply by 2 and annex 000 to the product.

$$\begin{array}{r} 856 \\ 1000 \\ \hline 856000 \end{array} \qquad \begin{array}{r} 856 \\ 2000 \\ \hline 1712000 \end{array}$$

To multiply Dollars and Cents by 1000, 2000, etc.

Multiply \$ 374.24 by 1000.

\$374.24	Annex 000 to the multiplicand.
<u>1000</u>	Then move the decimal point 3
\$374240.00	places to the right.

Multiply \$374.24 by 2000, 3000, etc.

\$374 24	Annex 000 to the multiplicand.
<u>2000</u>	Then move the decimal point 3
\$758480.00	places to the right. Multiply by 2.

Omit all naughts to the right of the decimal point in the answer.

To multiply by 50; by 25.

$$50 = \frac{1}{2} \text{ of } 100,$$

$$25 = \frac{1}{4} \text{ of } 100.$$

To multiply by 50, annex 00 to the multiplicand; then divide by 2.

To multiply by 25, annex 00 to the multiplicand; then divide by 4.

WRITTEN EXERCISE

1. Multiply :

628	962	738	842	765
<u>290</u>	<u>420</u>	<u>120</u>	<u>130</u>	<u>190</u>

2. Multiply :

\$1826	\$1305	\$17.73	\$14.92	\$16.74
<u>110</u>	<u>120</u>	<u>130</u>	<u>140</u>	<u>190</u>

Multiplicand of Three or More Orders: Multiplier of Three or More Orders

A. A barrel of flour weighs 196 lb. How much do 248 barrels weigh?

EXPLANATION OR FORM OF ANALYSIS. The weight of 248 bbl. will be 248 times the weight of 1 bbl.

Therefore, the answer is 248×196 lb.

Multiplicand	196 lb.
<u>Multiplier</u>	<u>248</u>
196 multiplied by 8 units	1568
196 multiplied by 4 tens	7840
196 multiplied by 2 hundreds	39200
196 lb. multiplied by 248	48608 lb. <i>Ans.</i>

A shorter way is to omit 0's and to arrange the work in this way:

$$\begin{array}{r}
 196 \text{ lb.} \\
 \underline{248} \\
 1568 \\
 784 \\
 \underline{392} \\
 48608 \text{ lb. } \textit{Ans.}
 \end{array}$$

NOTE.—When we multiply 196 by 8 *units*, the first figure of the partial product, 8, is in *units'* place; when we multiply by 4 *tens*, the first figure of the partial product, 4, is in *tens'* place; when we multiply by 1 *hundred*, the first figure of the partial product, 2, is in *hundreds'* place, etc.

B. A boat sails at the rate of 146 mi. each day. How far does it sail in 109 da.?

EXPLANATION OR FORM OF ANALYSIS. The distance sailed in 109 da. is 109 times the distance sailed in 1 da.

Therefore, the answer is 109×146 mi.

Multiplicand	146 mi.
<u>Multiplier</u>	<u>109</u>
9 units $\times 146$	1314
0 tens $\times 146$	0000
<u>1 hundred $\times 146$</u>	<u>14600</u>
109×146 mi.	15914 mi., distance traveled.

Arrange the work in this way: 146 mi.

$$\begin{array}{r}
 109 \\
 \underline{1314} \\
 146 \\
 \hline
 15914 \text{ mi.}
 \end{array}$$

Notice that 6 is in hundreds' place in the partial product.

C. Multiply 3747 by 2009.

Arrange the work in this way:

$$\begin{array}{r}
 3747 \\
 2009 \\
 \hline
 33723 \\
 7494 \\
 \hline
 7527723
 \end{array}$$

NOTE TO TEACHER.—An elementary knowledge of the Law of Commutation should be developed because many examples can be solved easily by the application of this principle; *e.g.* A baker bakes 1826 loaves; each loaf weighs 3 lb. What is the total weight? Logically, the solution is 1826×3 lb. If, however, the pupils understand that 1826×3 lb. = 3×1826 lb., they may obtain the answer by multiplying 1826 by 3 instead of multiplying 3 by 1826.

WRITTEN PROBLEMS

1. A yearly subscription to a magazine costs \$ 1.75. How much must be paid for 128 subscriptions? For 356 subscriptions?

2. A train carries 327 bbl. of meat. Each barrel weighs 250 lb. Find the total weight. (*Prove the answer.*)

3. A builder buys 265 loads of sand. Each load weighs 325 lb. Find the total weight.

4. A merchant makes a profit of \$ 1.15 on each pair of shoes. If he sells 316 pr., what is his profit? (*Prove the answer.*)

5. A hotel uses 138 loaves of bread a day. How many loaves will it use in 175 da. at that rate?

WRITTEN EXERCISE

1. Multiply:

394 trees	869 mi.	583 sq. ft.	\$ 17.61	\$ 29.86
<u>247</u>	<u>389</u>	<u>643</u>	<u>871</u>	<u>748</u>

2. Find the products of:

$592 \times 786;$	$847 \times 325;$
$341 \times 963;$	$428 \times 653;$
$827 \times 614;$	$764 \times 895.$

3. Multiply:

360	970	835	240	710
<u>316</u>	<u>421</u>	<u>385</u>	<u>419</u>	<u>247</u>

4. Find the products of :

300	multiplied	by	260 ;
807	"	"	302 ;
320	"	"	320 ;
500	"	"	400 ;
908	"	"	306 .

5. Multiply :

\$ 740	\$ 906	\$ 350	\$ 50.20	\$ 8.00
<u>620</u>	<u>809</u>	<u>700</u>	<u>308</u>	<u>500</u>

WRITTEN PROBLEMS

1. A baker uses 980 lb. of flour each day. How many pounds will be used in 120 da. at that rate ?

2. An express company delivers 278 packages. It charges \$1.25 for each package. How much money is paid for the delivery of all the packages ? (*Prove the answer.*)

3. I sell 108 tables at \$115 each. How much do I receive for them ?

4. A contractor employs 265 men. He pays them \$2.25 a day. How much money does he pay each day ? How much money does he pay in 6 da. ? (*Prove the answer.*)

5. A box manufacturer makes 297 paper boxes a day. How many boxes at that rate will be made in 134 da. ?

WRITTEN EXERCISE

1. Multiply:

938	831	746	532	2645
<u>642</u>	<u>135</u>	<u>247</u>	<u>116</u>	<u>1312</u>

2. Multiply:

307 chairs	809 tables	750 cars	930 horses	\$ 8.05
<u>214</u>	<u>329</u>	<u>268</u>	<u>124</u>	<u>139</u>

3. Multiply:

475	756	805	709	8004
<u>203</u>	<u>300</u>	<u>504</u>	<u>360</u>	<u>175</u>

4. Multiply:

\$ 73.60	\$ 83.05	\$ 4.00	7308 yd.	\$ 80.00
<u>129</u>	<u>371</u>	<u>256</u>	<u>764</u>	<u>600</u>

5. Multiply:

\$ 57.49	\$ 93.05	\$ 7650	\$ 9730	\$ 37.00
<u>308</u>	<u>602</u>	<u>203</u>	<u>109</u>	<u>200</u>

WRITTEN PROBLEMS

1. 498 passengers ride on a railroad. Each passenger pays \$ 2.58. How much money is paid by all the passengers?

2. A factory uses 396 loads of coal. Each load weighs 2000 lb. What is the total weight of the coal? (*Prove the answer.*)

3. It costs a firm \$ 1.38 each to print 650 books. What is the total cost? (*Prove the answer.*)

4. During the dull season a railroad office employed 126 men. During the busy season it employed 298 men. Each man received \$ 120 a month. How much more money was paid by the company each month during the busy season than during the dull season?

WRITTEN EXERCISE

1. Multiply:

1836 people	1249 lb.	\$ 23.16	\$ 3281
<u>1124</u>	<u>2216</u>	<u>1842</u>	<u>2112</u>

2. Find the products of:

1184×3647 ;	1286×2941 ;
2271×8319 ;	1468×3747 ;
2936×4871 ;	3746×2859 .

3. Multiply:

\$ 2930	\$ 4870	\$ 96.10	\$ 73.50	\$ 8470
<u>1265</u>	<u>1937</u>	<u>2641</u>	<u>3483</u>	<u>7429</u>

4. Find the products of:

4293	multiplied by	3092;
8962	"	" 2083;
3219	"	" 5000;
7412	"	" 1097;
2647	"	" 6000.

WRITTEN PROBLEMS

1. A builder buys 346 doors at \$10.72 each. How much does he pay for them?

2. A locomotive uses 198 gal. of water in a trip. How much water will be used in 118 trips at that rate? (*Prove the answer.*)

3. The following prices were *posted* in a market:

Baldwin apples, \$3.75 a barrel;

Spy apples, \$3.10 a barrel;

Russet apples, \$2.25 a barrel;

Cranberries, \$13.50 a barrel;

Oranges, \$2.75 a dozen.

Make 2 problems about each article. Solve each problem.

4. A flour manufacturer uses 875 bushels of wheat a day. How many bushels will he use in 238 days at that rate? Find the cost of the wheat at 75 cents a bushel. (*Prove the answer.*)

5. A trucking company has 170 horses and 85 wagons. Each horse is worth \$187. Each wagon is worth \$98. Find the value of all the horses and wagons.

WRITTEN EXERCISE

1. Multiply:

997	489	682	593	1495
<u>486</u>	<u>927</u>	<u>1824</u>	<u>4216</u>	<u>3175</u>

2. Find the products of:

$$\begin{array}{ll} 8316 \times 6483; & 2000 \times 8000; \\ 1274 \times 2975; & 3009 \times 4052; \\ 9347 \times 4368; & 4913 \times 6253. \end{array}$$

3. Multiply:

3750 books	8609 bbl.	\$ 50.03	\$ 3006
3479	2605	8009	7400

4. $9374 \times 2000 = ?$ $4628 \times 3000 = ?$
 $4000 \times 6500 = ?$ $7008 \times 2006 = ?$
 $2950 \times 8000 = ?$ $3746 \times 7000 = ?$

5. Multiply:

\$ 837.09	\$ 436.10	\$ 809.07	\$ 720.06
382	4007	3000	6304

WRITTEN PROBLEMS

1. 841 people go to an entertainment. Each person pays \$2.50. What are the total receipts? (*Prove the answer.*)

2. Find the cost of:

308 T. of hay @ \$17.50 a ton.
 596 bu. grain @ \$1.17 a bushel.
 740 lb. chicken @ \$.23 a pound.
 368 bbl. potatoes @ \$2.25 per barrel.

3. Make 2 more problems about each article in example 2. Solve each problem.

4. A salesman has 278 customers. He sells an average of 124 desks to each customer. How much does he sell in all? (*Prove the answer.*)

5. A company ships 487 cargoes of oil. Each cargo contains 396 bbl. Find the total number of barrels in all the cargoes.

WRITTEN EXERCISE

1. Multiply:

\$ 746	\$ 982	\$ 12.74	\$ 10.09	\$ 13.65
316	417	913	802	706
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

2. Find the products of:

2315 and 740; 7400 and 800; 6531 and 214;
6800 and 3500; 2895 and 304; 4719 and 2000.

3. Multiply:

\$ 1826	\$ 39.36	\$ 7496	\$ 21.70	\$ 9864
149	284	315	241	358
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

4. $\$ 3500 \times 1000 = ?$ $\$ 7400 \times 2500 = ?$
 $\$ 5360 \times 3000 = ?$ $\$ 4951 \times 6000 = ?$

5. Multiply:

2749 by 320.	4618 by 4343.
1526 by 250.	1627 by 1981.
1983 by 3728.	2955 by 683.

WRITTEN PROBLEMS

1. A farmer raises 17,385 bu. of wheat. He sells the wheat to a dealer for 45 ct. a bushel. The dealer sells it for 94 ct. a bushel. How much profit is made by the dealer?

2. A shoe firm has 86 stores. The *average daily receipts* of each store are \$1155.30. Find the amount received by all the stores in 12 da.

3. The average daily receipts of a store are \$365.80. The *average daily expenses* are \$140.30. What are the daily profits of 75 stores? What are the profits of 75 stores for 6 da.?

4. A merchant sells the following number of cherries: on Monday, 3516 baskets; on Tuesday, 2740 baskets; on Wednesday, 316 baskets; on Thursday, 6840 baskets. Each basket contains 3 qt. How much money is received for all the cherries at 9 cents a qt.?

WRITTEN EXERCISE

1. Multiply:

9371	8741	7105	1629	4826
<u>265</u>	<u>302</u>	<u>209</u>	<u>503</u>	<u>909</u>

2. Find the products of:

1721 and 651; 9316 and 429; 2830 and 718;
4008 and 939; 1709 and 462.

3. Multiply:

\$ 46.05	\$ 34.09	\$ 74.10	\$ 93.60	\$ 80.04
<u>338</u>	<u>429</u>	<u>515</u>	<u>882</u>	<u>646</u>

4. Multiply:

\$ 395.27	\$ 849.16	\$ 740.08	\$ 121.07
<u>193</u>	<u>632</u>	<u>475</u>	<u>913</u>

5. Multiply:

15293	29164	78109	54002
<u>716</u>	<u>833</u>	<u>427</u>	<u>948</u>

WRITTEN PROBLEMS

1. A company owns 80 houses. Each house is worth \$ 35,000. Find the value of all the houses.

2. Hay was sold for \$ 11.75 a ton. How much was paid for 3640 T.?

3. Find the cost of the following books:

1296 Robinson Crusoe . . . \$.67 each.

1872 Child's Garden of Verses \$.25 each.

2652 Black Beauty \$.55 each.

1440 Lobo, Rag, and Vixen . \$.37 each.

840 Longfellow's Poems . . \$ 1.75 each.

4. Find the cost of:

128 carriage horses at \$ 650 each;

326 work horses at \$ 250 each;

36 fire horses at \$ 650 each;

450 Shetland ponies at \$ 125 each.

5. A company employed the following:

2225 salesmen at \$ 220 per month;
 350 clerks at \$ 125 per month;
 150 delivery boys at \$ 45 per month.

How much money was paid to all for 1 month's work?

WRITTEN EXERCISE

1. Multiply the following by 3000; then by 4000:

\$ 131.64 \$ 931.76 \$ 829.48 \$ 761.29

2. Multiply:

14963	29401	30006	15829
<u>4783</u>	<u>6113</u>	<u>2515</u>	<u>8229</u>

3. Multiply:

\$ 473.28	\$ 630.06	\$ 210.07	\$ 436.15
<u>3027</u>	<u>5049</u>	<u>1203</u>	<u>4009</u>

4. Find the products of:

395 and 12,009; 420 and 16,030; 584 and 21,704; 2116 and 13,009; 4297 and 16,948.

- | | |
|------------------------------|----------------------------|
| 5. 320×1789 ft. = ? | 713×2174 bu. = ? |
| 197×2000 lb. = ? | 918×6307 gal. = ? |
| $487 \times \$ 1246$ = ? | 1728×8309 = ? |

6. A hardware dealer sold the following:

326 hammers at \$ 1.35 each;

450 saws at \$ 3.25 each;

198 planes at \$ 2.40 each.

How much money was received for all the articles?

7. A firm sells 360 automobiles at \$ 1675 each.
How much was received for them?

8. A railroad company carries an average of 526 passengers each trip. At that rate, how many passengers are carried in 274 trips?

9. A ticket agent sold the following during June:

340 tickets at \$.75 each ;

269 tickets at \$ 1.50 each ;

420 tickets at \$ 2.85 each.

How much money did he receive for each kind of ticket? How much money was received for all the tickets?

10. A company sold the following cash registers:

NUMBER SOLD	KIND	COST	SELLING PRICE
250	Style <i>A</i>	\$ 32	\$ 55
196	<i>B</i>	47.50	75
272	<i>C</i>	51	95
58	<i>D</i>	125.75	150

Find the gain on each style of cash register. Find the total gain on all the cash registers.

DIVISION

Review of Division Tables

Division Table of Twos

Memorize this table :

$2 \div 2 = 1$	$10 \div 2 = 5$	$18 \div 2 = 9$
$4 \div 2 = 2$	$12 \div 2 = 6$	$20 \div 2 = 10$
$6 \div 2 = 3$	$14 \div 2 = 7$	$22 \div 2 = 11$
$8 \div 2 = 4$	$16 \div 2 = 8$	$24 \div 2 = 12$

Division Table of Threes

Memorize this table :

$3 \div 3 = 1$	$15 \div 3 = 5$	$27 \div 3 = 9$
$6 \div 3 = 2$	$18 \div 3 = 6$	$30 \div 3 = 10$
$9 \div 3 = 3$	$21 \div 3 = 7$	$33 \div 3 = 11$
$12 \div 3 = 4$	$24 \div 3 = 8$	$36 \div 3 = 12$

Division Table of Fours

Memorize this table :

$4 \div 4 = 1$	$20 \div 4 = 5$	$36 \div 4 = 9$
$8 \div 4 = 2$	$24 \div 4 = 6$	$40 \div 4 = 10$
$12 \div 4 = 3$	$28 \div 4 = 7$	$44 \div 4 = 11$
$16 \div 4 = 4$	$32 \div 4 = 8$	$48 \div 4 = 12$

Division Table of Fives

Memorize this table :

$5 \div 5 = 1$	$25 \div 5 = 5$	$45 \div 5 = 9$
$10 \div 5 = 2$	$30 \div 5 = 6$	$50 \div 5 = 10$
$15 \div 5 = 3$	$35 \div 5 = 7$	$55 \div 5 = 11$
$20 \div 5 = 4$	$40 \div 5 = 8$	$60 \div 5 = 12$

Division Table of Sixes

Memorize this table :

$6 \div 6 = 1$	$30 \div 6 = 5$	$54 \div 6 = 9$
$12 \div 6 = 2$	$36 \div 6 = 6$	$60 \div 6 = 10$
$18 \div 6 = 3$	$42 \div 6 = 7$	$66 \div 6 = 11$
$24 \div 6 = 4$	$48 \div 6 = 8$	$72 \div 6 = 12$

Division Table of Sevens

Memorize this table :

$7 \div 7 = 1$	$35 \div 7 = 5$	$63 \div 7 = 9$
$14 \div 7 = 2$	$42 \div 7 = 6$	$70 \div 7 = 10$
$21 \div 7 = 3$	$49 \div 7 = 7$	$77 \div 7 = 11$
$28 \div 7 = 4$	$56 \div 7 = 8$	$84 \div 7 = 12$

Division Table of Eights

Memorize this table :

$8 \div 8 = 1$	$40 \div 8 = 5$	$72 \div 8 = 9$
$16 \div 8 = 2$	$48 \div 8 = 6$	$80 \div 8 = 10$
$24 \div 8 = 3$	$56 \div 8 = 7$	$88 \div 8 = 11$
$32 \div 8 = 4$	$64 \div 8 = 8$	$96 \div 8 = 12$

Division Table of Nines

Memorize this table :

$9 \div 9 = 1$	$45 \div 9 = 5$	$81 \div 9 = 9$
$18 \div 9 = 2$	$54 \div 9 = 6$	$90 \div 9 = 10$
$27 \div 9 = 3$	$63 \div 9 = 7$	$99 \div 9 = 11$
$36 \div 9 = 4$	$72 \div 9 = 8$	$108 \div 9 = 12$

Division Table of Tens

Memorize this table :

$10 \div 10 = 1$	$50 \div 10 = 5$	$90 \div 10 = 9$
$20 \div 10 = 2$	$60 \div 10 = 6$	$100 \div 10 = 10$
$30 \div 10 = 3$	$70 \div 10 = 7$	$110 \div 10 = 11$
$40 \div 10 = 4$	$80 \div 10 = 8$	$120 \div 10 = 12$

Division Table of Elevens

Memorize this table:

$11 \div 11 = 1$	$55 \div 11 = 5$	$99 \div 11 = 9$
$22 \div 11 = 2$	$66 \div 11 = 6$	$110 \div 11 = 10$
$33 \div 11 = 3$	$77 \div 11 = 7$	$121 \div 11 = 11$
$44 \div 11 = 4$	$88 \div 11 = 8$	$132 \div 11 = 12$

Division Table of Twelves

Memorize this table:

$12 \div 12 = 1$	$60 \div 12 = 5$	$108 \div 12 = 9$
$24 \div 12 = 2$	$72 \div 12 = 6$	$120 \div 12 = 10$
$36 \div 12 = 3$	$84 \div 12 = 7$	$132 \div 12 = 11$
$48 \div 12 = 4$	$96 \div 12 = 8$	$144 \div 12 = 12$

In $72 \div 12 = 6$, the number **72** is the **dividend**, the number **12** is the **divisor**, the number **6** is the **quotient**.

In $72 \div 10 = 7$ and 2 over, the **quotient** is **7**, and the number **2** is the **remainder**.

ORAL DRILL

Tell the quotients:

- | | | |
|-------------------|--------------------|--------------------|
| 1. $63 \div 7.$ | 20. $9 \div 3.$ | 39. $120 \div 12.$ |
| 2. $121 \div 11.$ | 21. $48 \div 12.$ | 40. $18 \div 2.$ |
| 3. $108 \div 9.$ | 22. $72 \div 12.$ | 41. $132 \div 11.$ |
| 4. $72 \div 6.$ | 23. $72 \div 8.$ | 42. $100 \div 10.$ |
| 5. $48 \div 4.$ | 24. $108 \div 9.$ | 43. $28 \div 4.$ |
| 6. $50 \div 10.$ | 25. $66 \div 11.$ | 44. $64 \div 8.$ |
| 7. $24 \div 2.$ | 26. $32 \div 4.$ | 45. $96 \div 12.$ |
| 8. $8 \div 2.$ | 27. $36 \div 6.$ | 46. $80 \div 8.$ |
| 9. $36 \div 9.$ | 28. $81 \div 9.$ | 47. $54 \div 9.$ |
| 10. $33 \div 3.$ | 29. $24 \div 8.$ | 48. $90 \div 10.$ |
| 11. $27 \div 9.$ | 30. $18 \div 6.$ | 49. $30 \div 5.$ |
| 12. $32 \div 11.$ | 31. $18 \div 2.$ | 50. $36 \div 12.$ |
| 13. $44 \div 11.$ | 32. $77 \div 11.$ | 51. $84 \div 7.$ |
| 14. $36 \div 4.$ | 33. $144 \div 12.$ | 52. $77 \div 7.$ |
| 15. $72 \div 9.$ | 34. $96 \div 8.$ | 53. $44 \div 4.$ |
| 16. $66 \div 6.$ | 35. $14 \div 2.$ | 54. $54 \div 6.$ |
| 17. $35 \div 7.$ | 36. $80 \div 10.$ | 55. $56 \div 8.$ |
| 18. $60 \div 12.$ | 37. $24 \div 12.$ | 56. $90 \div 9.$ |
| 19. $56 \div 7.$ | 38. $14 \div 7.$ | 57. $33 \div 11.$ |

NOTE TO TEACHER. — The drills on pages 98, 99, 100, and 101 are intended for rapid oral work. Each pupil is to have a copy of the book. The teacher is to state the number of the example; the pupils are to give the answer instantly.

The exercises are valuable also as "busy work" and as an aid to the application of the Group System.

ORAL DRILL

Find the missing numbers (multiples and factors):

- | | |
|-----------------------|----------------------|
| 1. $* + 5 = 5.$ | 25. $* + 7 = 8.$ |
| 2. $* + 6 = 7.$ | 26. $16 \div * = 4.$ |
| 3. $* + 7 = 4.$ | 27. $81 \div * = 9.$ |
| 4. $* + 3 = 5.$ | 28. $64 \div * = 8.$ |
| 5. $* + 10 = 5.$ | 29. $36 \div * = 6.$ |
| 6. $28 \div * = 4.$ | 30. $49 \div * = 7.$ |
| 7. $18 \div * = 3.$ | 31. $* + 10 = 10.$ |
| 8. $18 \div * = 6.$ | 32. $* + 8 = 12.$ |
| 9. $18 \div * = 9.$ | 33. $* \div 12 = 8.$ |
| 10. $18 \div * = 2.$ | 34. $* \div 4 = 11.$ |
| 11. $* + 4 = 5.$ | 35. $* + 11 = 11.$ |
| 12. $* \div 5 = 4.$ | 36. $9 \div * = 3.$ |
| 13. $* \div 12 = 6.$ | 37. $28 \div * = 4.$ |
| 14. $* + 5 = 6.$ | 38. $36 \div * = 3.$ |
| 15. $* + 2 = 10.$ | 39. $18 \div * = 3.$ |
| 16. $96 \div * = 12.$ | 40. $56 \div * = 7.$ |
| 17. $32 \div * = 4.$ | 41. $* \div 3 = 2.$ |
| 18. $24 \div * = 8.$ | 42. $* + 9 = 4.$ |
| 19. $48 \div * = 8.$ | 43. $* \div 6 = 6.$ |
| 20. $16 \div * = 8.$ | 44. $* \div 12 = 3.$ |
| 21. $* + 6 = 9.$ | 45. $* \div 4 = 9.$ |
| 22. $* + 12 = 12.$ | 46. $24 \div * = 8.$ |
| 23. $* \div 10 = 9.$ | 47. $24 \div * = 2.$ |
| 24. $* \div 9 = 7.$ | 48. $24 \div * = 4.$ |

ORAL DRILL

Factors of Numbers Less than 50

Tell the factors of each of the following numbers :

- | | |
|----------------|----------------|
| 1. 9, 15, 27. | 6. 20, 8, 25. |
| 2. 14, 40, 32. | 7. 48, 60, 44. |
| 3. 28, 35, 42. | 8. 24, 18, 12. |
| 4. 10, 6, 33. | 9. 21, 4, 2. |
| 5. 45, 49. | 10. 16, 3, 22. |

11. Tell the common factors of the numbers in example 1 ; in 2 ; in 3 ; in 4.

ORAL DRILL

Tell the different sets of factors of each of the following numbers :

- | | |
|---------------------|------------------------|
| 1. 24, 28, 32, 121. | 6. 54, 63, 70, 99. |
| 2. 25, 35, 120, 16. | 7. 72, 80, 81, 132. |
| 3. 27, 36, 40, 18. | 8. 84, 88, 96, 50. |
| 4. 30, 60, 64, 77. | 9. 48, 90, 66, 100. |
| 5. 42, 49, 56, 12. | 10. 36, 144, 104, 120. |

ORAL EXERCISE

Find the least common multiple of:

- | | |
|--------------|--------------|
| 1. 6, 8, 12. | 4. 3, 9, 12. |
| 2. 3, 4, 6. | 5. 4, 8, 12. |
| 3. 2, 5, 10. | 6. 3, 4, 5. |

Add the quotients:

1. $28 \div 4$ and $14 \div 7$.
2. $35 \div 5$ " $24 \div 4$.
3. $24 \div 4$ " $16 \div 8$.
4. $36 \div 6$ " $18 \div 2$.
5. $49 \div 7$ " $20 \div 4$.
6. $96 \div 12$ " $18 \div 6$.
7. $25 \div 5$ " $40 \div 8$.
8. $80 \div 10$ " $27 \div 3$.
9. $99 \div 11$ " $30 \div 10$.
10. $27 \div 3$ " $36 \div 6$.
11. $30 \div 5$ " $48 \div 6$.
12. $30 \div 6$ " $44 \div 11$.
13. $42 \div 6$ " $42 \div 7$.
14. $56 \div 7$ " $56 \div 8$.
15. $88 \div 11$ " $40 \div 8$.
16. $24 \div 8$ " $24 \div 3$.
17. $32 \div 4$ " $108 \div 12$.
18. $60 \div 12$ " $144 \div 12$.
19. $27 \div 9$ " $27 \div 3$.
20. $30 \div 10$ " $30 \div 3$.
21. $108 \div 12$ " $64 \div 8$.
22. $72 \div 6$ " $120 \div 10$.
23. $32 \div 8$ " $72 \div 12$.
24. $63 \div 9$ " $56 \div 8$.
25. $45 \div 9$ " $27 \div 3$.

Oral Review Problems. Division Tables

1. Our teacher placed 48 readers in 4 equal piles; how many readers are there in each pile?
2. She gave out 72 sheets of paper. Each pupil received 3 sheets. To how many pupils did she give paper?
3. If a class uses 4 sticks of chalk every day, in how many days will it use 60 sticks of chalk?
4. If the quotient is 7 and the dividend 42, what is the divisor?
5. Tell the smallest number that may be subtracted from 50 to make a number divisible by 7.
6. I divided 49 marbles equally among 7 boys. How many marbles did each boy receive?
7. If there are 54 soldiers in 6 equal rows, how many soldiers are there in each row?
8. The product of two numbers is 84. One of the numbers is 6. What is the other?
9. I multiplied a number by 9; the answer was 63. What was the number?
10. Tell the smallest number that may be added to 27 to make a number exactly divisible by 6?
11. A man earns \$18 in 6 da. How much does he earn per day?
12. How many yards of ribbon costing 7 ct. per yard may be bought for 42 ct.?

13. At 6 ct. apiece, how many notebooks may be bought for 54 ct.?

14. The distance from A to X is 6 times as great as the distance from A to C . If the distance from A to X is 72 mi., what is the distance from A to C ?

A ————— X

A ——— C

15. George skates twice as fast as Henry. If George skates 6 mi. in an hour, how many miles will Henry skate in an hour?

16. A sailboat travels 10 times as fast as a rowboat. If the sailboat goes 20 mi. in 3 hr., how far will the rowboat go in that time?

17. A horseshoer makes 32 shoes. This will do for how many horses?

18. A man bought 9 baskets of grapes. They cost \$1.08. What is the cost of 1 basket?

19. 8 bottles of mucilage cost 56 ct. How much does 1 bottle cost at that rate?

20. 4 doz. handkerchiefs cost \$48. Find the cost of 1 doz. at that rate.

21. Gloves were packed 6 pr. in a box. How many boxes are needed for 42 pr.?

22. How many 3-lb. bags are needed for 21 lb. of salt?

23. A grocer has 24 lb. of coffee. If he puts it into 4-lb. cans, how many cans must he have? If he puts it into 6-lb. cans? Into 8-lb. cans?

24. 12 plants cost \$ 24. Find the cost of 1 plant.

25.

QUANTITY	TOTAL COST	COST OF ONE
12 lb. rice	72 ct.	?
8 lb. oatmeal	32 "	?
5 lb. farina	40 "	?
6 lb. starch	24 "	?
7 lb. sugar	42 "	?
9 cans peaches	90 "	?
2 cans soup	24 "	?
10 packages crackers	80 "	?
4 bottles milk	32 "	?

26. Annie has 25 ct. to buy post cards. How many may she buy if 3 cards cost 5 ct.?

27. Post cards cost 3 for 5 ct. Find the cost of 24 cards.

28. Jack buys 6 small flags for 5 ct. At that price, how many flags may he buy for 30 ct.? For 40 ct.?

29. Flags cost 6 for 5 ct. How much do 42 flags cost at that price? 48 flags? 66 flags?

30. A grocer has 36 oranges. He sells them at the rate of 6 for 10 ct. How much money does he receive?

31. A grocer sells oranges at the rate of 6 for 10 ct. How many oranges does he sell for \$1? For 80 ct.?

32. How much greater is $12 \div 4$ than $8 \div 4$?

33. How much do 9 boxes of strawberries cost at the rate of 3 boxes for 11 ct.?

34. In a class the number of absentees was as follows: on Monday 3, Tuesday 2, Wednesday 1, Thursday 2, Friday 2. How many absentees for the week? What was the *average number* absent each day?

35. A boy saved his money for 4 wk. He saved 11 ct. the first week, 9 ct. the second week, 15 ct. the third week, and 9 ct. the fourth week. What were his total savings? What were his average weekly savings?

36. There are 3 groups in one class; the groups contain 15, 10, and 11 pupils *respectively*. What is the average number of pupils in a group?

37. 7 boys are 11, 12, 13, 10, 11, 12, and 8 yr. old respectively. What is their average age?

38. I bought 6 toys costing 12 ct., 19 ct., 15 ct., 10 ct., 21 ct., and 7 ct. What was the average cost of the toys?

39. Fred had 10 examples correct on Monday, 7 on Tuesday, 8 on Wednesday, 5 on Thursday, and 5 on Friday. What was his daily average?

Cross References: Multiplication.
Fractions.

Forms of Explanation or Analysis

A. A boy divides 124 marbles into 4 equal groups. How many marbles are in each group?

EXPLANATION OR FORM OF ANALYSIS. The number of marbles in each group is $\frac{1}{4}$ the number of marbles in 4 groups.

Therefore the number of marbles is $\frac{1}{4}$ of 124, or $124 \div 4 = 31$.

B. 6 hats cost \$4.50; how much does 1 hat cost?

EXPLANATION. 1 hat costs $\frac{1}{6}$ as much as 6 hats. Therefore 1 hat costs $\frac{1}{6}$ of \$4.50, or $\$4.50 \div 6$.

C. A train travels 150 mi. in 5 hr. How many miles does it travel in 1 hr.?

EXPLANATION. The distance traveled in 1 hr. is $\frac{1}{5}$ the distance traveled in 5 hr.

Therefore the distance traveled in 1 hr. is $\frac{1}{5}$ of 150 mi., or $150 \text{ mi.} \div 5 = 30 \text{ mi.}$

D. 6 bu. of grain were sold for \$4.80. Find the cost of 3 bu. at that rate.

EXPLANATION. 3 bu. cost $\frac{1}{2}$ as much as 6 bu.

Therefore 3 bu. cost $\frac{1}{2}$ of \$4.80, or $\$4.80 \div 2$.

E. How many blank books costing 9 cents each can I buy for \$1.89?

EXPLANATION. I can buy as many blank books as there are 9's in 189.

Therefore the number of blank books is $189 \div 9$.

Divisors of One Order

WRITTEN EXERCISE

1. Divide: 426 by 3; 759 by 3; 368 by 2; 720 by 4; 720 by 5.

2. Divide: 540 by 2, by 3, by 4, by 5, by 6.

3. $\$576 \div 3 = ?$ $\$2.65 \div 5 = ?$ $\$372 \div 6 = ?$
 $\$912 \div 2 = ?$ $\$5.20 \div 4 = ?$ $\$896 \div 6 = ?$

Find quotients:

4. $3 \overline{)873}$ $2 \overline{)738}$ $5 \overline{)365}$ $4 \overline{)600}$ $6 \overline{)192}$

5. Divide: $\$8.38$ by 2; $\$7.64$ by 4; $\$855$ by 3; $\$732$ by 6; $\$630$ by 5.

WRITTEN PROBLEMS

1. A tank holds 124 qt. of water. How many times must I use a pitcher that holds 4 qt. to empty the tank?

2. A grocer put 310 lb. of salt into 5-lb. bags. How many bags were there?

3. A boat sails 3 mi. an hour. How long will it take to sail 261 mi. at that rate?

4. How long does it take a boat to sail 292 mi. at the rate of 4 mi. an hour?

5. A building is 260 ft. high. A second building is $\frac{1}{2}$ as high. A third is $\frac{1}{4}$ as high. Find the height of the second building; of the third building.

ORAL EXERCISE

1. Divide: 224 by 7; 360 by 5; 604 by 4; 378 by 6; 468 by 9.

2. Divide: 268 by 4; 282 by 3; 416 by 4; 364 by 7; 336 by 8.

3. $\$198 \div 9 = ?$ $\$5.58 \div 6 = ?$ $\$375 \div 3 = ?$
 $\$296 \div 4 = ?$ $\$16.50 \div 3 = ?$ $\$427 \div 7 = ?$

4. Find quotients:

$3 \overline{)762}$ $8 \overline{)968}$ $6 \overline{)432}$ $7 \overline{)294}$ $9 \overline{)378}$

5.

How many times are \$5 contained in \$125?

"	"	"	"	6 in.	"	"	492 in.?
"	"	"	"	7 gal.	"	"	504 gal.?
"	"	"	"	8 lb.	"	"	576 lb.?
"	"	"	"	9 ft.	"	"	648 ft.?

ORAL PROBLEMS

1. Our class read 126 pages in 9 da. How many pages did we read in 1 da.?

2. If 8 boys require 256 sheets of paper, how many sheets will each boy need?

3. How many 9-ct. blank books can I buy for \$2.88?

4. A boy can write 8 words on a line. How many lines will he use in writing a composition of 248 words?

5. 7 boys sharpen 133 lead pencils. Each boy sharpens an equal number. How many does each boy sharpen?

WRITTEN EXERCISE

1. Find the quotients:

Dividend	465	1449	1302	2037	2576
Divisor	3	9	6	7	8

2. Divide: 3987 by 9; 8589 by 7; 7512 by 6; 9736 by 8; 7716 by 4.

3. Find quotients:

\$27.36 ÷ 4	\$92.54 ÷ 7	\$4698 ÷ 9
\$85.32 ÷ 6	\$7536 ÷ 8	\$71.34 ÷ 6

4. Find quotients:

7)3766	9)8748	4)4932	8)9152
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5. How many times does \$8440 contain \$5?

"	"	"	"	9002 gal.	"	7 gal.?
"	"	"	"	5008 in.	"	8 in.?
"	"	"	"	8001 ft.	"	9 ft.?
"	"	"	"	9102 yd.	"	6 yd.?

WRITTEN PROBLEMS

1. How many whistles must a man sell at 6 ct. each to receive \$5.88? At 3 ct. each? At 2 ct. each?

2. A boat sails 8 mi. an hour. How far will it sail in 120 hr.? In 15 da.?

3. Make another example like No. 2. Solve it.

4. How many dozen in 612 pencils?

5. 1880 lb. of crackers are packed in boxes. Each box contains 8 lb. of crackers. How many boxes are used?

6. I paid \$20.25 for berries, at 9 ct. a quart. How many quarts did I buy?

ORAL EXERCISE

1. Divide: 259 by 7; 384 by 6; 475 by 5; 824 by 8; 714 by 7.

2. Divide: \$14.28 by 7; \$36.24 by 6; \$80.04 by 4; \$102.06 by 2; \$28.02 by 3.

3. $498 \div 6 = ?$	$434 \div 7 = ?$	$496 \div 8 = ?$
$1535 \div 5 = ?$	$567 \div 9 = ?$	$364 \div 4 = ?$

4. Find quotients:

$5 \overline{)2605}$	$8 \overline{)3360}$	$9 \overline{)4680}$	$9 \overline{)2880}$	$7 \overline{)8435}$
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5.

How many times does 2406 lb. contain 6 lb.?

"	"	"	"	3440 gal.	"	8 gal.?
"	"	"	"	13,770 yd.	"	9 yd.?
"	"	"	"	\$1250	"	\$5?
"	"	"	"	2889 bu.	"	9 bu.?

ORAL PROBLEMS

1. \$192 is how many times \$8?

2. A man paid \$3.78 for 6 chairs. How much did he pay for 1 chair?

3. A bar of lead weighs 8 lb. How many bars will be required to weigh 176 lb. ?

4. There are 154 boys in a room. If they are arranged in 7 equal groups, how many boys will there be in each group ?

5. 7 tables cost \$ 2.87. What is the cost of 1 table ?

WRITTEN EXERCISE

1. Divide : 7848 by 9; 4664 by 8; 15,645 by 7; 89,264 by 11; 65,532 by 12.

2. Find quotients :

$$8)\underline{\$147.36} \quad 12)\underline{\$98.52} \quad 11)\underline{\$89.32}$$

$$9)\underline{\$57.33} \quad 7)\underline{\$82.46} \quad 8)\underline{\$40.96}$$

3. $48,825 \div 9 = ?$ $79,310 \div 11 = ?$

$5664 \div 12 = ?$ $36,840 \div 8 = ?$

$51,121 \div 7 = ?$ $74,520 \div 12 = ?$

4. How many times is 12 contained in 35,980 ?

" " " " 6 " " 43,236 ?

" " " " 8 " " 65,208 ?

" " " " 9 " " 19,827 ?

" " " " 7 " " 24,850 ?

5. 8183 is how many times 7 ?

3576 " " " " 12 ?

66,720 " " " " 8 ?

48,888 " " " " 9 ?

39,102 " " " " 6 ?

WRITTEN PROBLEMS

1. A plate of glass contained 288 sq. ft. It was divided into 9 panes of glass of equal size. How many square feet in each pane?

2. A bin contains 300 bu. of grain. How many times must a basket holding 8 bu. be used to empty the bin?

3. How many boxes are needed for each of the following?

528 pr. of stockings, 12 in a box;

726 neckties, 6 in a box;

489 shirts, 9 in a box;

248 handkerchiefs, 8 in a box;

300 collars, 12 in a box.

Find the total number of boxes.

4. Find the cost of 1 article if:

7 plates cost \$3.85;

9 cups cost \$2.16;

12 saucers cost \$2.88;

8 knives cost \$20;

6 forks cost \$4.50.

5. 12 coats cost \$81. How much do 6 coats cost? 3 coats? 4 coats? 2 coats? 1 coat?

ORAL EXERCISE

1. Divide \$ 154 into 5 equal parts. How much in each part?

Divide \$ 275 into 3 equal parts. How much in each part?

Divide \$ 418 into 4 equal parts. How much in each part?

2. Divide \$ 3.65 into 6 equal parts. How much in each part?

Divide \$ 4.27 into 5 equal parts. How much in each part?

3. Find quotients:

4)283 in. 4)441 hr. 6)184 bu. 7)354 gal.

4. Divide: 2177 by 7; 4527 by 9; 2506 by 5.

5. Divide: 3224 by 4; 3542 by 5; 4837 by 6.

ORAL PROBLEMS

1. 5 pencil boxes cost 47 ct. Find the average cost.

2. 6 pencils cost 34 ct. How much do 3 pencils cost? (*Use direct method.*)

3. A car goes 51 mi. in 7 hr. How many miles does it go in 1 hr.?

4. A horse travels 31 mi. in 8 hr. How many miles does it travel in 4 hr.? (*Use direct method.*)

5. Harry is told to arrange 183 blank books in piles of 6 books in each pile. How many piles are there? How many books left over?

WRITTEN EXERCISE

1. Divide: 3715 by 9; 3185 by 7; 4634 by 8; 15,212 by 6; 35,514 by 5.

2. $8 \overline{)4561}$ $7 \overline{)3373}$ $6 \overline{)34,742}$ $9 \overline{)5119}$ $5 \overline{)80,503}$

3. Divide 3217 into 8 equal parts.

" 42,725 " 6 " "

" 35,254 " 5 " "

" 63,148 " 7 " "

" 27,362 " 9 " "

4. How many times does 4616 contain 9?

" " " " 3001 " 8?

" " " " 4001 " 6?

" " " " 17,005 " 7?

" " " " 14,003 " 5?

5. Divide: 2743 by 4, by 8; 3921 by 2, by 4, by 8; 16,502 by 3, by 6, by 9.

WRITTEN PROBLEMS

1. A plot of ground 188 ft. long was divided into 8 equal lots. How many feet in the length of each lot?

2. A machine printed 246 papers in 7 min. At that rate, how many papers does it print in 1 min.? In 3 min.?

3. A family pays \$93 for 6 months' rent. How much rent is paid each month?

4. One farmer raises 326 bu. of potatoes. This

is 9 times as many as a second farmer raises. How many bushels are raised by the second farmer?

5. How many baskets containing 6 bu. each are needed for 355 bu. of grain? How many bushels of grain are left over?

ORAL EXERCISE

- | | | | | | |
|-------------|--------------|--------------|--------------|--------------|--------------|
| 1. Dividend | 275 | 372 | 406 | 825 | 728 |
| Divisor | $\frac{2}{}$ | $\frac{3}{}$ | $\frac{5}{}$ | $\frac{8}{}$ | $\frac{9}{}$ |
| Quotient | ? | ? | ? | ? | ? |
2. $656 \div 5 = ?$ $763 \div 7 = ?$ $649 \div 8 = ?$
 $576 \div 8 = ?$ $818 \div 9 = ?$ $283 \div 9 = ?$
3. Divide: \$649 by 6; \$3.65 by 7; \$7.29 by 8.
4. $2635 \div 2 = ?$ $4227 \div 3 = ?$ $1825 \div 6 = ?$
 $3559 \div 5 = ?$ $2561 \div 8 = ?$ $9328 \div 7 = ?$
5. Divide: 8296 by 2; 9427 by 3; 3841 by 6; 5040 by 8; 7492 by 7.

ORAL PROBLEMS

1. A plot of ground 98 ft. long is divided into 6 equal parts. How many feet in each part?
2. If a plot 126 ft. long is divided into 4 equal parts, how many feet are there in each part?
3. A boy increases 15 lb. in weight in 6 mo. How many pounds' increase each month?
4. A store sells 5 lamps for \$48. How much does 1 lamp cost?

5. One pupil solves 18 problems. Another pupil solves only 4 examples. The first solves ? times as many examples as the second. (Find the number for "?".)

WRITTEN EXERCISE

1. Divide: 3521 by 12; 4713 by 8; 2839 by 9; 8305 by 7; 4001 by 6.

2. $2615 \div 9 = ?$ $3749 \div 7 = ?$ $2812 \div 12 = ?$
 $4564 \div 8 = ?$ $3257 \div 6 = ?$ $7492 \div 7 = ?$

3. Divide \$91.15 into 8 equal parts.

"	\$23.71	" 12	"	"
"	\$35.16	" 9	"	"
"	\$29.43	" 7	"	"
"	\$37.15	" 6	"	"

4. $12 \overline{)4415}$ $9 \overline{)3640}$ $6 \overline{)1850}$ $8 \overline{)6420}$

5. Find quotients: 9937 divided by 8; 4130 divided by 12; 8752 divided by 9.

6. Divide the sum of 296 and 1350 by 9.

7. Divide the difference of 2750 and 1684 by 7.

8. Multiply 728 by 36; divide the product by 5.

9. How much greater is $4927 \div 8$ than $4927 \div 3$?

10. Divide 18,963 by 9; multiply the quotient by 58

WRITTEN PROBLEMS

1. A car from New York to Stamford, Conn., starts from New York at 1 P.M. The rate of speed is 8 mi. per hour.

Fill in the blank spaces with correct answers.

STATIONS	DISTANCE FROM NEW YORK	FARE AT 8 CT. A MILE	TIME OF ARRIVAL
Mount Vernon .	12 mi.		
Pelham	16 mi.		
New Rochelle . .	18 mi.		
Rye	24 mi.		
Riverside . . .	30 mi.		
Stamford	34 mi.		

2. A car from New York to New Rochelle starts from New York at 1:30 P.M. The rate of speed is 6 mi. per hour.

Fill in the blank spaces with correct answers.

STATIONS	DISTANCE FROM NEW YORK	FARE AT 2 CT. A MILE	TIME OF ARRIVAL
Port Morris . .	2 mi.		
Hunts Point . .	3 mi.		
West Farms . .	4 mi.		
Van Nest . . .	5 mi.		
Westchester . .	6 mi.		
City Island . .	9 mi.		
Woodside . . .	11 mi.		
New Rochelle . .	18 mi.		

ORAL EXERCISE

1. Divide: 107 by 4; 608 by 6; 308 by 3; 721 by 6; 709 by 7.

2. $9002 \div 3 = ?$ $6551 \div 5 = ?$ $8247 \div 8 = ?$
 $2975 \div 9 = ?$ $5625 \div 7 = ?$ $4735 \div 7 = ?$

3. Divide: \$48.64 by 8; \$30.05 by 5; \$21.07 by 7; \$1320 by 6; \$27.09 by 9.

4. Find quotients:

$9 \overline{)1264}$ $8 \overline{)8325}$ $7 \overline{)2941}$ $6 \overline{)8400}$ $4 \overline{)4112}$

5. Divide: 3600 by 8; 3840 by 6; 4870 by 9.

ORAL PROBLEMS

1. A family uses 7 cakes of ice in a week. The total weight is 357 lb. How many pounds in each cake?

2. 9 boxes of water colors cost \$24.75. Find the cost of 1 box.

3. A monitor was told to give 6 sheets of paper to each pupil. He had 75 sheets. How many pupils were there? How many sheets were left over?

4. A car travels 9 mi. an hour. In how many hours will it travel 40 mi.?

5. Find the cost of 1 chair, if 8 chairs cost \$35.

WRITTEN EXERCISE

3900 by 9; 4703 by 10; 2100 by 11; 33,500 by 8.

quotients:

$$\underline{1935}$$

$$10 \overline{)1436}$$

$$8 \overline{)7141}$$

$$11 \overline{)8619}$$

$$9 \overline{)8315}$$

3. Divide 2716 into 10 equal parts

" 4832 " 11 " "

" 7519 " 9 " "

" 8009 " 12 " "

" 7305 " 8 " "

4. Find quotients:

$$9 \overline{)3715}$$

$$7 \overline{)16,830}$$

$$8 \overline{)19,540}$$

$$12 \overline{)85,714}$$

$$10 \overline{)37,462}$$

5. How many 12's in 15,361?

" " 9's " 17,243?

" " 10's " 43,709?

" " 11's " 64,200?

" " 8's " 33,715?

WRITTEN PROBLEMS

1. Find the cost of 1 article if:

12 spools of cotton cost 75 ct.;

8 packages of needles cost 42 ct.;

10 packages of pins cost 65 ct.;

12 thimbles cost \$ 1;

2. I put 12 doz. pins into each of 21 boxes. If I have 256 doz. pins, how many dozen are left over?

3. How many years in 226 mo.?

4. A wagon carries 1305 boxes of grapes in 9 trips. At that rate, how many does it carry in 3 trips? In 6 trips?

Divisors 10, 20, etc., to 90

Review the division table of tens, page 96.

To divide a number that ends in 0 by 10, strike out the 0 in the dividend.

$$\begin{array}{r} \text{e.g. } 10 \overline{) 80} \\ \underline{8} \\ 0 \end{array} \quad \begin{array}{r} 10 \overline{) 60} \\ \underline{6} \\ 0 \end{array} \quad \begin{array}{r} 10 \overline{) 370} \\ \underline{37} \\ 0 \end{array} \quad \begin{array}{r} 10 \overline{) 3960} \\ \underline{396} \\ 0 \end{array}$$

Method of dividing numbers that end in 0 by numbers like 20, 30, 40, 50.

$$\begin{array}{r} 20 \overline{) 180} \\ \underline{9} \\ 0 \end{array} \quad \begin{array}{r} 50 \overline{) 750} \\ \underline{15} \\ 0 \end{array} \quad \begin{array}{r} 40 \overline{) 9840} \\ \underline{246} \\ 0 \end{array}$$

Method of dividing by 10 when the dividend does not end in 0.

$$\begin{array}{r} 10 \overline{) 17} \\ \underline{1} \\ 7 \end{array} \quad \begin{array}{r} 10 \overline{) 193} \\ \underline{19} \\ 3 \end{array} \quad \begin{array}{r} 10 \overline{) 1349} \\ \underline{134} \\ 9 \end{array}$$

Method of dividing by 20, 30, 40, etc., when the dividend does not end in 0.

$$\begin{array}{r} 20 \overline{) 83} \\ \underline{4} \\ 3 \end{array} \quad \begin{array}{r} 30 \overline{) 137} \\ \underline{4} \\ 7 \end{array} \quad \begin{array}{r} 50 \overline{) 4321} \\ \underline{86} \\ 1 \end{array}$$

Divisors of Two Orders

WRITTEN EXERCISE

1. Divide: 1395 by 30; 1224 by 51; 2444 by 52.

2. Find the quotients:

$$52 \overline{)4888}$$

$$52 \overline{)3328}$$

$$20 \overline{)2728}$$

3. Divide: \$3300 by 22; \$2601 by 51; \$1513.64 by 20.

4. How many times does 7392 contain 32?

“ “ “ “ 3094 “ 90?

“ “ “ “ 2976 “ 62?

5. Divide 8601 into 60 equal parts.

“ 4324 “ 92 “ “

“ 3738 “ 42 “ “

WRITTEN PROBLEMS

1. A contractor employs 82 laborers. He pays them \$1230. How much money does each one receive?

2. A boat sails at the rate of 22 mi. an hour. In how many hours will it sail 308 mi.?

3. If a boat sails 192 mi. in 12 hr., how many miles does it sail in 1 hr. (at what rate does it sail)?

4. An expressman has an order to deliver 728 packages. His wagon can carry only 52 packages.

How many trips must he make to deliver all the packages?

5. An expressman divides 2112 packages into 22 equal groups. How many packages in each group?

WRITTEN EXERCISE

1. Divide: 2080 by 32; 8505 by 80; 25,326 by 42.

2. Find the quotients:

$$\begin{array}{r} 20 \overline{)6447} \qquad 72 \overline{)3816} \qquad 52 \overline{)185,071} \end{array}$$

3. Divide: \$42.68 by 82; 7515 in. by 32; 5908 gal. by 21.

4. How much is:

$\frac{1}{22}$ of 1842 bu.; $\frac{1}{41}$ of 9365 qt.; $\frac{1}{80}$ of 17,304 in.?

5. Divide 42,195 sq. ft. into 92 equal parts.

“ 60,080 yd. “ 32 “ “

“ 71,500 lb. “ 61 “ “

WRITTEN PROBLEMS

1. How many boxes are used for 7812 qt. of cherries if each box holds 72 qt.?

2. An agent sold 1440 machines in 32 wk. How many did he sell each week, *on an average*?

3. A school uses 42 doz. pencils a week. In how many weeks will it use 1176 doz. pencils?

4. A family pays \$32 for rent each month. In how many months will it pay \$768?

5. A principal divides 1480 pupils into classes. Each class has 40 pupils. How many classes are there?

WRITTEN EXERCISE

1. Divide: 7892 by 42; 6508 by 62; 7183 by 41.

2. Find the quotients:

$$62 \overline{)18,305}$$

$$92 \overline{)27,406}$$

$$70 \overline{)45,047}$$

3. Divide: \$88.47 by 31; \$96.49 by 52.

4. Divide 7432 bu. into 82 equal parts.

“ 5000 in. “ 61 “ “

WRITTEN PROBLEMS

1. A baker uses 42 bbl. of flour each week. In how many weeks will he use 2100 bbl. at that rate?

2. A merchant sells an average of 22 doz. handkerchiefs a week. In how many weeks will he sell 1012 doz. at that rate?

3. A dealer sells 92 bbl. of apples for \$736. How much does he receive for 1 bbl.?

4. A city contains 64,512 people. A town contains $\frac{1}{42}$ as many people. How many people in the town?

5. If a train travels at the rate of 32 mi. an hour, in how many hours will it travel 576 mi.?

WRITTEN EXERCISE

1. Divide 834 1725 1006
by 49 28 39
2. Divide 4219 3304 1502
by 59 58 60
3. Find quotients: 38)327 42)475 39)869
4. Find quotients: 62)\$ 26.15 59)\$ 349.26
5. Divide 375 feet into 29 equal parts.
 " 5520 gal. " 46 " "
 " 1896 yd. " 55 " "

WRITTEN PROBLEMS

1. A typewriting machine costs \$85. How many may be purchased for \$2210?
2. A baker uses 94 lb. of flour each day. At that rate, in how many days will he use 4418 lb. of flour?
3. A man pays \$38 a month for rent. In how many months will he pay \$912?
4. 72 toys are packed in each box. How many boxes are needed for 3456 toys?
5. Mr. Smith earns \$35 a week. He spends \$19 a week. In how many weeks will he save \$464?

WRITTEN EXERCISE

1. Divide: 13,502 by 45; 16,309 by 58.
2. How many times does 895 bu. contain 45 bu.?
 " " " " 1642 in. " 79 in.?
 " " " " 3006 oz. " 84 oz.?
3. Find quotients:
 84)2635 75)3395 95)17,308
4. Find quotients:
 28)\$37.44 34)\$116.39 97)\$514.36
5. Divide: 38,169 by 37; 25,193 by 28.

WRITTEN PROBLEMS

1. A train goes at the rate of 46 mi. an hour. In how many hours will it go 782 mi.?
2. A yard of carpet costs 95 ct. How many yards may I buy for \$39.90?
3. A merchant sold 450 pr. of shoes in 25 da. How many pairs of shoes did he sell each day, on an average?
4. A school contains 1665 pupils. How many classes are there in the school, if each class contains 45 pupils?
5. A furniture dealer sold tables at a profit of \$26 each. How many tables must be sold to make a total profit of \$832?

WRITTEN EXERCISE

1. Divide: 46,394 by 86; 72,509 by 93.

2. Find quotients:

$$55 \overline{)10084} \quad 97 \overline{)7937} \quad 56 \overline{)15268}$$

3. How many times is 84 lb. contained in 12,460 lb.?

4. How many times is 78 in. contained in 14,728 in.?

5. Find $\frac{1}{95}$ of 75,600; find $\frac{1}{83}$ of 35,006.

6. Divide: 98,130 by 47;
 36,302 " 75;
 14,691 " 93;
 129,600 " 84.

WRITTEN PROBLEMS

1. If 48 pianos cost \$6000, how much will 1 piano cost?

2. How many yards of ribbon, costing 23 ct. a yard, can be bought for \$14.95?

3. I divide 185 books equally among 37 children. How many books does each child receive?

4. A merchant sells an average of 73 hats a week. In how many weeks will he sell 876 hats, at that rate?

5. If a boat sails 27 mi. an hour, in how many hours will it sail 486 mi.?

WRITTEN EXERCISE

1. Divide: \$134.16 by 68; \$200.28 by 79.
2. Divide: 18,394 by 27 24,608 by 39
 75,326 " 46 192,471 " 58.
3. Find quotients:
 71)39,205 37)47,982 99)94,176
4. How many times does \$9876 contain 84?
 " " " " 1746 yd. " 35?
 " " " " 3647 mi. " 77?
5. Find: $\frac{1}{35}$ of 3472; $\frac{1}{89}$ of 6938; $\frac{1}{64}$ of 84,932.

WRITTEN PROBLEMS

1. An agent sold 936 sewing machines in 36 wk. How many machines did he sell each week, on an average?
2. A boat uses 67 T. of coal on each trip. In how many trips will it use 1407 T. of coal?
3. A merchant sells 78 bbl. of apples for \$ 936. How much does he receive for 1 bbl.?
4. A dealer sells desks for \$ 28 each. How many desks are sold for \$896?
5. One train travels at the rate of 54 mi. an hour. Another train travels at the rate of 36 mi. an hour. In how many hours will the first train travel 810 mi.? In how many hours will the second train travel the same distance?

Divisors 100, 200, etc., to 900.

Method of dividing numbers by 100.

$$\begin{array}{r} 100 \overline{)3700} \\ 37 \end{array}$$

$$\begin{array}{r} 100 \overline{)48 \overline{)67}} \\ 48 \overline{)67} \\ 100 \end{array}$$

Method of dividing numbers by 200 to 900.

$$\begin{array}{r} 200 \overline{)4600} \\ 23 \end{array}$$

$$\begin{array}{r} 500 \overline{)63 \overline{)93}} \\ 12 \overline{)93} \\ 500 \end{array}$$

Divisors 1000, 2000 . . . etc.

Method of dividing numbers by 1000.

$$\begin{array}{r} 1000 \overline{)43000} \\ 43 \end{array}$$

$$\begin{array}{r} 1000 \overline{)3 \overline{)869}} \\ 3 \overline{)869} \\ 1000 \end{array}$$

$$\begin{array}{r} 1000 \overline{)29 \overline{)547}} \\ 29 \overline{)547} \\ 1000 \end{array}$$

Method of dividing numbers by 2000, etc.

$$\begin{array}{r} 2000 \overline{)58000} \\ 29 \end{array}$$

$$\begin{array}{r} 2000 \overline{)6 \overline{)749}} \\ 3 \overline{)749} \\ 1000 \end{array}$$

$$\begin{array}{r} 6000 \overline{)13 \overline{)147}} \\ 2 \overline{)147} \\ 6000 \end{array}$$

EXERCISE

1. Divide by 100; by 300; by 600:
600; 1800; 2400; 3000; 3600.
2. Divide by 200; by 400:
2250; 700; 1375; 920; 1681.
3. Divide by 500:
2740; 3500; 2694; 13,327; 1926.
4. Divide by 1000:
4000; 7200; 19,360; 28,749.
5. Divide by 1000; by 2000; by 4000:
8000; 9600; 23,460; 99,212; 17,693.
6. Divide by 6000; by 9000:
18,000; 21,300; 31,420; 65,197; 29,499.

Divisors of more than Two Orders

1. Divide 18,306 by 274.

$ \begin{array}{r} 66 \\ 274 \overline{)1830} \overline{)6} \\ \underline{1644} \times \\ 1866 \\ \underline{1644} \\ 222 \end{array} $	<p>1830 is the 1st <i>partial dividend</i>.</p> <p>$1830 \div 274 = 6$ and a remainder of 186.</p> <p>1866 is the 2d <i>partial dividend</i>.</p> <p>$1866 \div 274 = 6$ and a remainder of 222.</p> <p>$66\frac{222}{274} = 66\frac{111}{137}$ <i>Ans.</i></p>
$66\frac{222}{274}$ or $66\frac{111}{137}$ <i>Ans.</i>	

In this example the second figure of the quotient (6) is the same as the first figure. Therefore it is unnecessary to multiply the divisor by 6 again. Time may be saved by copying the product (1644) from the line above.

2. \$386.27 by 145.

$ \begin{array}{r} \$2.66 \\ 145 \overline{)\$386.27} \\ \underline{290} \times \times \\ 962 \\ \underline{870} \\ 927 \\ \underline{870} \\ 57 \end{array} $	<p>Divide as in the preceding example.</p> <p><i>Write the decimal point in the quotient above the decimal point in the dividend.</i></p>
$\$2.66\frac{57}{145}$ <i>Ans.</i>	

See note to example 1.

3. 738,342 by 1457.

$ \begin{array}{r} 506 \\ 1457 \overline{) 7383,42} \\ \underline{6285} \times \times \\ 984 \ 2 \\ \underline{874} \ 2 \\ 1100 \\ 506 \overline{) 1100} \text{ Ans.} \end{array} $	<p>7383 is the 1st <i>partial dividend</i>. $7383 \div 1457 = 5$ and a remainder.</p> <p>984 is the 2d <i>partial dividend</i>. 984 cannot be divided by 1457; write 0 in the quotient.</p> <p>9842 is the 3d <i>partial dividend</i>. $9842 \div 1457 = 6$ and a remainder of 1100. $506 \overline{) 1100} \text{ Ans.}$</p>
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4. Divide 920,008 by 36,502.

$ \begin{array}{r} 25 \\ 36502 \overline{) 920008} \\ \underline{73004} \times \\ 189968 \\ \underline{182510} \\ 7458 \\ 25 \overline{) 7458} = 25 \overline{) 7458} \text{ Ans.} \end{array} $	<p>92,000 is the 1st <i>partial dividend</i>. $92,000 \div 36,502 = 2$ and a remainder.</p> <p>189,968 is the 2d <i>partial dividend</i>. $189,968 \div 36,502 = 5$ and a remainder of 7458.</p> <p>$25 \overline{) 7458} = 25 \overline{) 7458} \text{ Ans.}$</p>
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WRITTEN EXERCISE

1. Divide: 3150 by 126; 5624 by 152; 9144 by 127.

2. Find quotients:

$$358 \overline{) 850.45} \qquad 307 \overline{) \$746.01} \qquad 675 \overline{) 3295}$$

3. Divide: 197,882 by 326; 296,400 by 459; 435,750 by 871.

DIVISORS OF MORE THAN TWO ORDERS 131

4. $41,987 \text{ bu.} \div 347 = ?$

$81,650 \text{ lb.} \div 355 = ?$

$146,320 \text{ oz.} \div 472 = ?$

5. Divide: 232,104 by 456; 394,200 by 657;
524,361 by 554.

WRITTEN PROBLEMS

1. 9792 oranges are packed in boxes. Each box contains 12 doz. oranges. How many boxes are there?

2. A building uses 1250 cu. ft. of gas in an hour. In how many hours will it use 156,250 cu. ft.?

3. A company pays \$37,490 to 115 clerks. How much does each clerk receive?

4. 15,255 boxes are shipped to New York in cars. Each car contains 105 boxes. How many cars are needed?

5. A furniture dealer makes a profit of \$3.75 on each table. How many tables must be sold to make a profit of \$97.50?

WRITTEN EXERCISE

1. Divide: 12,415 by 191; 27,470 by 134;
65,374 by 243.

2. Find quotients:

$$743 \overline{) \$4458}$$

$$789 \overline{) \$4773.45}$$

$$254 \overline{) \$9306.05}$$

3. Divide: 596,295 by 945; 457,905 by 623; 800,000 by 347.

4. How many times does 936,520 contain 156?

“ “ “ “ 841,715 “ 298?

“ “ “ “ 613,829 “ 741?

5. Divide: \$ 394.62 by \$ 315; \$ 702.60 by \$ 350; \$ 931.75 by \$ 284.

WRITTEN PROBLEMS

1. If a storekeeper makes a profit of \$ 6.35 a day, in how many days will his profit be \$ 1846.25?

2. A coal dealer has an order for 1632 T. of coal. He delivers the coal at the rate of 136 T. a day. In how many days will he fill the order?

3. A hotel uses 456 lb. of meat a day. In how many days will it use 56,088 lb. at that rate?

4. A railroad company spends \$ 265 a week for repairs. In how many weeks will it spend \$ 7255?

5. 168 overcoats cost \$ 7560. How much does 1 overcoat cost? How much do 7 overcoats cost? 48 overcoats?

WRITTEN EXERCISE

1. Divide: 205,674 by 315; 315,836 by 872; 748,293 by 653.

2. Find quotients:

$$209 \overline{)395,471}$$

$$502 \overline{)931,452}$$

$$317 \overline{)435,572}$$

3. Divide: \$196,964 by 246; 656,507 bu. by 951; 740,998 pk. by 815.

4.

How many times does 2577 bu. contain 121 bu.?

" " " " 27,470 yd. " 205 yd.?

" " " " 85,045 pk. " 233 pk.?

5. Find quotients:

$243 \overline{)74,601}$ da. $256 \overline{)79,104}$ qt. $502 \overline{)91,705}$ in.

WRITTEN PROBLEMS

1. How many barrels are needed for 48,804 lb. of flour? (196 lb. of flour in each barrel.)

2. How many barrels are needed for 4100 lb. of sugar, if each barrel contains 250 lb.?

3. Paper fasteners are packed in boxes. Each box holds 288 fasteners. How many boxes are needed for 64,512?

4. At \$136 each, how many pianos may be bought for \$6664?

5. I bought 140 sofas for \$6300. How much do I gain or lose by selling them for \$42 each?

WRITTEN EXERCISE

1. Divide: 976,415 by 492; 1,950,000 by 615; 2,500,000 by 225.

2. $708 \overline{)795,000}$ $906 \overline{)260,000}$ $503 \overline{)641,755}$

3. Divide: 218,316 gal. by 336; 481,650 qt. by 642; 926,503 in. by 728.

4.

How many times does \$ 79,194 contain \$ 256?

“ “ “ “ \$ 528,400 “ \$ 900?

“ “ “ “ \$ 465,300 “ \$ 250?

5. Find: $\frac{1}{3\frac{1}{2}}$ of \$ 18,500; $\frac{1}{2\frac{1}{5}}$ of 316,420 mi.; $\frac{1}{3\frac{1}{5}}$ of 318,000 da.

WRITTEN PROBLEMS

1. Find the cost of 1 horse, if 164 horses cost \$ 39,852.

2. The total receipts of a store are \$ 6410 in 285 da. What are the average daily receipts?

3. A book company sells dictionaries at \$ 1.25 each. It receives \$ 18.75 for them. How many dictionaries were sold?

4. A printer's press prints 145 circulars in 1 min. In how long will it print 19,720 circulars?

5. A boat carries 136 boxes. They weighed 7344 lb. If the boxes are of equal weight, how much does each one weigh?

WRITTEN EXERCISE

1. Divide: 907,305 by 702; 1,836,115 by 596; 3,100,000 by 719.

2. Find quotients:

$$985 \overline{)275,983} \qquad 594 \overline{)395,876} \qquad 480 \overline{)350,940}$$

3. Find: $\frac{1}{86}$ of 382,747; $\frac{1}{39}$ of 982,936; $\frac{1}{74}$ of 508,769.

4. How many times does 487,139 contain 149?

“ “ “ “ 650,208 “ 296?

“ “ “ “ 749,613 “ 384?

5. Divide: 853,196 by 374; 1,153,647 by 498; 3,500,160 by 564.

WRITTEN PROBLEMS

1. 740 tickets are sold for \$1110. How much does each ticket cost?

2. It costs \$15,000 to pave a street with asphalt. The street contains 12,500 sq. yd. What is the cost of paving 1 sq. yd.?

3. Peaches are bought for \$1.50 a box. They are sold for \$2.40 a box. At that rate, how many boxes must be sold to gain \$414?

4. A company sells 150,000 lead pencils at 25 ct. a box. There are 240 pencils in a box. How much is paid for the pencils?

5. 420 plots of ground were bought for \$224,700. How much did 1 plot cost?

6. 26 pairs of shoes were bought at \$1.75 a pair. All the shoes were sold for \$65. How much profit was made on each pair?

7. A storekeeper spent \$190 in 6 days. His total receipts during that time were \$350. Find his average profit for one day.

8. A boat sails 215 miles the first day, 235 miles the second day, 184 miles the third day, and 240 miles the fourth day. Find the average distance sailed each day.

9. 72 chairs are bought for \$108. They are sold for \$2.25. How much profit is made on each chair?

10. A grocer bought 36 barrels of flour for \$216. He sold the flour at 7 ct. a pound. Find his gain.

11. 14 doz. umbrellas are bought for \$504. Find the cost of 1 umbrella.

12. 24 doz. lead pencils are sold for \$13.96. Find the cost of 1 pencil.

13. A manufacturer packs 10,800 pencils in boxes. There are 144 pencils in each box. Find the cost of all the pencils if each box costs \$4.85.

14. A book costs \$1.75. It is sold at \$2.25. At that rate of profit, how many books must be sold to gain \$80?

15. 730 books are to be placed on 45 shelves. 20 shelves hold 14 books each. How many books must be placed on each of the remaining shelves?

FRACTIONS

Terms of a Fraction

You have done many examples with numbers like $\frac{1}{2}$, $\frac{2}{4}$, $\frac{5}{8}$, and $\frac{3}{8}$. Such numbers are called **fractions**.

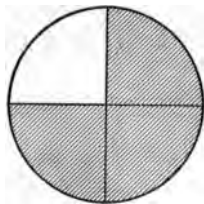
Numbers like 1, 4, 65, 128 are called **whole numbers** or **integers**.

Numbers like $1\frac{1}{2}$, $2\frac{1}{4}$, $10\frac{3}{8}$ are called **mixed numbers**.

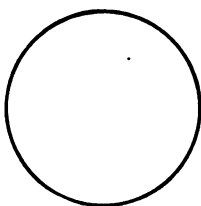
In any fraction the number written below the line denotes the name of the parts. It is called the **denominator**. The number written above the line denotes the number of the parts. It is called the **numerator**.

For example, the shaded part of the circle may be represented by $\frac{3}{4}$; the number "4," or "denominator," tells the number of parts into which the circle is divided, and gives the name to the parts—"fourths"; while the numerator 3 tells how many "fourths" are spoken of.

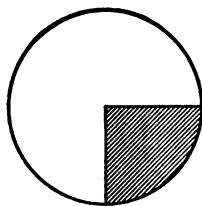
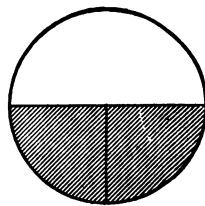
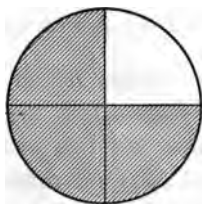
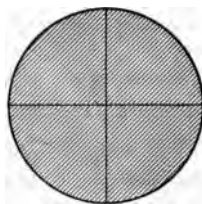
The denominator and numerator are together called the **terms** of a fraction; 4 and 3 are the *terms* of the fraction $\frac{3}{4}$. Every fraction has two terms.



Name the denominators and the numerators of the following fractions: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{7}{10}$, $\frac{11}{12}$, $\frac{17}{20}$, $\frac{19}{45}$, $\frac{61}{105}$, $\frac{457}{500}$.

Proper and Improper Fractions

Unit Circle = 1

 $\frac{1}{4}$  $\frac{2}{4}$  $\frac{3}{4}$  $\frac{4}{4}$

1. How many fourths in 1 unit? In 2 units? In 3 units? In 4 units?

2. How many fourths in $1\frac{1}{4}$? In $1\frac{2}{4}$? In $1\frac{3}{4}$?

Fractions like $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$ are called **proper fractions**, because their value is less than 1 (unit).

The numerator of a proper fraction is smaller than the denominator. Why?

Fractions like $\frac{4}{4}$, $\frac{5}{4}$, $\frac{7}{4}$, $\frac{8}{4}$, $\frac{9}{4}$, etc., are called **improper fractions**, because their value is equal to 1 or greater than 1.

The numerator of an improper fraction is equal to or larger than the denominator. Why?

3. Consider the answers to question 1 above. Are these answers proper or improper fractions? Why?

4. Are the answers to question 2 proper or improper fractions? Why?

ORAL EXERCISE

1. Name all the proper fractions whose denominators are 4.

2. Name proper fractions having 3 as a numerator; having 5; having 6; having 8; having 12.

3. Name 3 improper fractions with 2 as denominator; with 4; with 3; with 5; with 6; with 10.

WRITTEN EXERCISE

Put into separate columns the proper and the improper fractions among the following: $\frac{3}{8}$, $\frac{1}{2}$, $\frac{7}{9}$, $\frac{9}{7}$, $\frac{2}{3}$, $\frac{9}{10}$, $\frac{10}{11}$, $\frac{10}{10}$, $\frac{1}{12}$, $\frac{18}{2}$, $\frac{16}{15}$, $\frac{3}{3}$, $\frac{12}{12}$, $\frac{13}{12}$, $\frac{2}{2}$.

Changing a Whole Number to an Improper Fraction

1. How many quarter apples in 2 apples?

2. How many fourths in 2?

SOLUTION

We write:

$$1 = \frac{4}{4}$$

$$2 = \frac{2 \times 4}{4} = \frac{8}{4} \text{ Ans.}$$

EXPLANATION

We say: Since there are 4 fourths in 1, in 2 there are 2 times 4 fourths, or 8 fourths.

3. How many fourths in 3? In 4? In 5? In 7? In 10?

4. How many half melons in 1 melon? In 2 melons? In 5 melons? In 6 melons? In 9 melons?

5. How many thirds in 1? In 2? In 3? In 5? In 8? In 10?

6. How many fifths in 1? In 2? In 3? In 5? In 10? In 8? In 20?

7. How many eighths in 1? In 3? In 5? In 7? In 10? In 12? In 6?

8. How many tenths in 1? In 2? In 5? In 6? In 9? In 10? In 12? In 15?

WRITTEN EXERCISE

1. How many fourths in 125?

SOLUTION

$$1 = \frac{4}{4}$$

$$125 = \frac{125 \times 4}{4} = \frac{500}{4} \text{ Ans.}$$

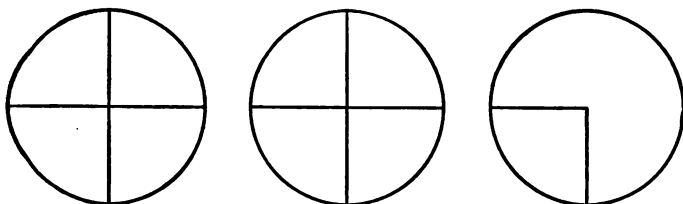
The short way is $4 \times 125 = 500$. The answer is $\frac{500}{4}$.

2. How many thirds in 225?

3. How many thirds in 56? In 110? In 200? In 275?

4. How many fourths in 25? In 65? In 75? In 225?

5. How many eighths in 40? In 72? In 120? In 250?

Changing a Mixed Number to an improper Fraction

1. How many quarter apples in 2 apples and 1 quarter apple?
2. How many fourths in $2\frac{1}{4}$?

SOLUTION

$$\begin{aligned}
 1 &= \frac{4}{4} \\
 2 &= \frac{8}{4} \\
 2\frac{1}{4} &= \frac{9}{4} \text{ Ans.}
 \end{aligned}$$

EXPLANATION

$2\frac{1}{4}$ means $2 + \frac{1}{4}$.
 Since there are $\frac{4}{4}$ in 1, there are $\frac{2 \text{ times } 4}{4}$, or $\frac{8}{4}$, in 2; and there are $\frac{8}{4}$ plus $\frac{1}{4}$ or $\frac{9}{4}$ in $2\frac{1}{4}$.

Here is a short way to do it:

$$2\frac{1}{4} = \frac{2 \times 4 + 1}{4} = \frac{9}{4} \text{ Ans.}$$

We say: "4 times 2 are 8; 8 and 1 make 9." The answer is 9 fourths, $\frac{9}{4}$.

3. How many fourths in $2\frac{3}{4}$? In $3\frac{1}{4}$? In $4\frac{1}{4}$? In $1\frac{3}{4}$?
4. How many thirds in $2\frac{1}{3}$? In $4\frac{2}{3}$? In $3\frac{1}{3}$? In $1\frac{2}{3}$?
5. How many halves in $2\frac{1}{2}$? In $3\frac{1}{2}$? In $4\frac{1}{2}$? In $7\frac{1}{2}$?
6. How many fifths in $2\frac{2}{5}$? In $3\frac{1}{5}$? In $4\frac{4}{5}$? In $1\frac{4}{5}$?

7. How many sixths in $2\frac{1}{6}$? In $3\frac{1}{6}$? In $2\frac{5}{6}$? In $5\frac{5}{6}$?

Change to an improper fraction:

8. $3\frac{2}{3}$. 11. $6\frac{3}{5}$. 14. $8\frac{5}{8}$. 17. $10\frac{4}{5}$. 20. $7\frac{1}{3}$.
 9. $5\frac{3}{8}$. 12. $10\frac{1}{8}$. 15. $11\frac{1}{8}$. 18. $8\frac{5}{8}$. 21. $9\frac{4}{8}$.
 10. $12\frac{1}{2}$. 13. $12\frac{2}{3}$. 16. $9\frac{2}{7}$. 19. $7\frac{5}{9}$. 22. $7\frac{1}{7}$.

23. How do you change a mixed number to an improper fraction?

WRITTEN EXERCISE

1. How many fourths in $155\frac{1}{4}$?

SOLUTION

155¹

$\frac{4}{621}$ fourths, $621\frac{1}{4}$ Ans.

EXPLANATION

In 155 units there are 155 times 4 fourths, which are 620 ; 1 fourth more makes $621\frac{1}{4}$.

2. How many fourths in $56\frac{1}{4}$? In $125\frac{3}{4}$? In $236\frac{1}{4}$? In $435\frac{3}{4}$?

Reduce (or change) to an improper fraction:

3. $122\frac{1}{2}$. 7. $100\frac{3}{8}$. 11. $33\frac{1}{3}$. 15. $66\frac{2}{3}$.
 4. $72\frac{3}{4}$. 8. $60\frac{3}{5}$. 12. $37\frac{1}{2}$. 16. $112\frac{1}{2}$.
 5. $128\frac{2}{3}$. 9. $18\frac{3}{4}$. 13. $22\frac{2}{9}$. 17. $249\frac{3}{7}$.
 6. $47\frac{1}{7}$. 10. $57\frac{1}{7}$. 14. $125\frac{1}{4}$. 18. $266\frac{2}{3}$.

19. Reduce to improper fractions: \$ $12\frac{1}{4}$, \$ $15\frac{1}{2}$, \$ $26\frac{3}{4}$, \$ $31\frac{1}{8}$, \$ $47\frac{5}{8}$.

20. Reduce to improper fractions: $31\frac{1}{2}$ gal., $18\frac{3}{4}$ bu., $16\frac{2}{3}$ yd., $125\frac{1}{3}$ cu. in.

ORAL PROBLEMS

1. How many quarter-yard lengths may be made from a piece of linen 20 yd. long?

2. How many fifths of a mile must I run in order to go 6 mi.?

3. If a grocer makes up 10 lb. of tea in quarter-pound packages, how many packages will he have?

4. How many half pints of oil in a vessel holding $12\frac{1}{2}$ pints?

5. I have $\$6\frac{3}{4}$ in silver quarters. How many quarters have I?

6. How many quarters in 8 whole oranges?

7. It is $\frac{1}{8}$ of a mile around the block. How many times must I go around the block to walk $10\frac{5}{8}$ mi.?

8. How many half bushels of corn in a bin holding $21\frac{1}{2}$ bu.?

WRITTEN EXERCISE

Change:

1. 25 to eighths.

4. $156\frac{3}{4}$ to fourths.

2. 75 to twelfths.

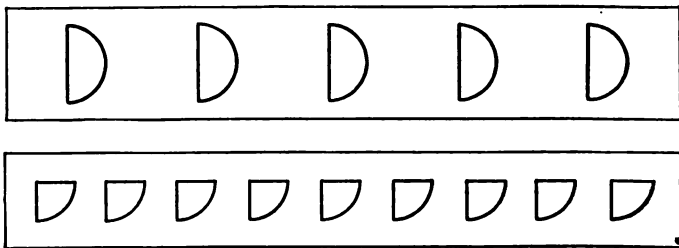
5. $81\frac{8}{9}$ to ninths.

3. $133\frac{1}{3}$ to thirds.

6. $205\frac{3}{7}$ to sevenths.

- | | |
|----------------------------------|-------------------------------------|
| 7. $46\frac{5}{8}$ to sixths. | 14. $166\frac{2}{3}$ to thirds. |
| 8. 50 to tenths. | 15. 40 to fifteenths. |
| 9. $67\frac{3}{5}$ to fifths. | 16. $33\frac{9}{10}$ to twentieths. |
| 10. 125 to twelfths. | 17. $141\frac{1}{6}$ to sixteenths. |
| 11. $72\frac{3}{8}$ to eighths. | 18. 90 to fourteenths. |
| 12. $116\frac{2}{3}$ to thirds. | 19. $88\frac{8}{9}$ to ninths. |
| 13. $71\frac{3}{7}$ to sevenths. | 20. $38\frac{3}{4}$ to fourths. |

Changing an Improper Fraction to an Integer or a Mixed Number



1. In the first picture we have 5 half circles.
How many whole circles in $\frac{5}{2}$ circles?

It takes 2 half circles to make a whole circle.

It takes 4 half circles to make 2 whole circles.

So in $\frac{5}{2}$ circles we have 2 whole circles and $\frac{1}{2}$ circle more. We may do the example without looking at the picture in this way:

SOLUTION

$$\frac{2}{2} = 1$$

$$\frac{5}{2} = 5 \div 2 = 2\frac{1}{2} \text{ Ans.}$$

EXPLANATION

Since $\frac{2}{2} = 1$, $\frac{5}{2} =$ as many
1's as $5 \div 2$, or $2\frac{1}{2}$.

2. Looking at the second picture, tell how many wholes (or units) in 9 fourths.

SOLUTION

EXPLANATION

$$\frac{4}{4} = 1$$

Since $\frac{4}{4} = 1$, $\frac{9}{4}$ = as many

$$\frac{9}{4} = 9 \div 4 = 2\frac{1}{4} \text{ Ans.}$$

1's as $9 \div 4$, or $2\frac{1}{4}$.

3. How many wholes in $\frac{7}{2}$? In $\frac{9}{2}$? In $\frac{10}{2}$?
In $\frac{11}{2}$? In $\frac{15}{2}$?

4. How many units in $\frac{5}{4}$? In $\frac{7}{4}$? In $\frac{11}{4}$?
In $\frac{13}{4}$? In $\frac{15}{4}$?

5. Since $\frac{3}{3} = 1$, how many 1's in $\frac{10}{3}$? In $\frac{7}{3}$?
In $\frac{15}{3}$?

6. Since $\frac{5}{5} = 1$, how many 1's in $\frac{10}{5}$? In $\frac{15}{5}$?
In $\frac{12}{5}$? In $\frac{9}{5}$?

7. How do you change an improper fraction to a whole or a mixed number?

ORAL EXERCISE

Change to whole numbers:

- | | | | | |
|---------------------|----------------------|---------------------|----------------------|----------------------|
| 1. $\frac{24}{6}$. | 4. $\frac{30}{10}$. | 7. $\frac{24}{4}$. | 10. $\frac{12}{6}$. | 13. $\frac{36}{6}$. |
| 2. $\frac{15}{3}$. | 5. $\frac{16}{8}$. | 8. $\frac{50}{5}$. | 11. $\frac{24}{3}$. | 14. $\frac{36}{4}$. |
| 3. $\frac{20}{4}$. | 6. $\frac{21}{3}$. | 9. $\frac{12}{2}$. | 12. $\frac{18}{2}$. | 15. $\frac{36}{9}$. |

Reduce to mixed numbers:

- | | | | | |
|----------------------|----------------------|----------------------|----------------------|----------------------|
| 16. $\frac{25}{6}$. | 19. $\frac{30}{7}$. | 22. $\frac{19}{4}$. | 25. $\frac{13}{2}$. | 28. $\frac{36}{7}$. |
| 17. $\frac{15}{4}$. | 20. $\frac{16}{3}$. | 23. $\frac{40}{7}$. | 26. $\frac{25}{3}$. | 29. $\frac{35}{4}$. |
| 18. $\frac{20}{3}$. | 21. $\frac{17}{4}$. | 24. $\frac{32}{3}$. | 27. $\frac{18}{5}$. | 30. $\frac{36}{5}$. |

WRITTEN EXERCISE

1. Change $\frac{127}{15}$ to a whole or a mixed number.

SOLUTION

$$\begin{aligned}\frac{127}{15} &= 127 \div 15 \\ &= 8\frac{7}{15}\end{aligned}$$

EXPLANATION

Since $\frac{15}{15} = 1$, $\frac{127}{15} =$ as many 1's as $127 \div 15 = 8\frac{7}{15}$ Ans.

(Note that $\frac{127}{15} = \frac{120}{15} + \frac{7}{15} = 8$ units + $\frac{7}{15} = 8\frac{7}{15}$ Ans.)

Reduce to integers or mixed numbers:

1. $\frac{81}{3}$. 4. $\frac{141}{5}$. 7. $\frac{800}{9}$. 10. $\frac{193}{12}$. 13. $\frac{5176}{15}$.
 2. $\frac{90}{7}$. 5. $\frac{225}{9}$. 8. $\frac{250}{3}$. 11. $\frac{1000}{9}$. 14. $\frac{2336}{25}$.
 3. $\frac{140}{8}$. 6. $\frac{150}{10}$. 9. $\frac{75}{4}$. 12. $\frac{2264}{7}$. 15. $\frac{6940}{31}$.

WRITTEN PROBLEMS

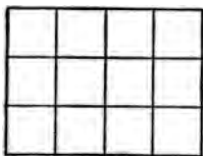
1. A ticket seller at a circus took in 641 silver quarters. How many dollars had he?
2. A grocer bought 133 cans of oil each holding $\frac{1}{6}$ of a gallon. How many gallons of oil did he buy?
3. A boy ran 40 times around a track which measured $\frac{1}{8}$ mi. How many miles did he run?
4. A grocer made up 150 packages of pepper each weighing $\frac{1}{4}$ lb. How many pounds of pepper did he use?
5. A baker uses $\frac{1}{2}$ lb. flour in making a loaf of bread. How much flour would he use in making 225 loaves?

The Denominator

1. An apple is to be divided equally among some boys. What part will each boy receive, if there are only 2 boys? If there are 3 boys? If there are 4 boys? If there are 5 boys? If there are 6 boys?



2. When the number of boys is increased, is each one's share of the apple increased or *diminished* in size?



1. How many parts in this oblong? What is each part called?

2. How many parts in $\frac{1}{2}$ of the oblong? In $\frac{1}{3}$? In $\frac{1}{4}$? In $\frac{1}{6}$?

If we arrange the answers in a table, we have:

$$\frac{1}{2} = 6 \text{ twelfths.}$$

$$\frac{1}{4} = 3 \text{ twelfths.}$$

$$\frac{1}{3} = 4 \text{ twelfths.}$$

$$\frac{1}{6} = 2 \text{ twelfths.}$$

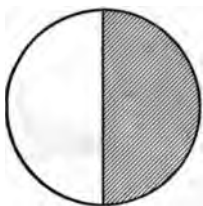
3. Which fraction is the greatest in value? The smallest in value?

4. Which fraction has the largest denominator?

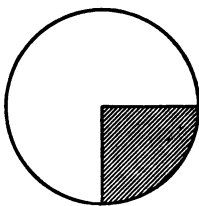
5. Which fraction has the smallest denominator?

The smaller the denominator, the greater is the value of the fraction if the numerator remains the same.

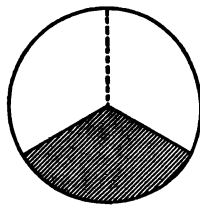
The larger the denominator, the less is the value of the fraction if the numerator remains the same.



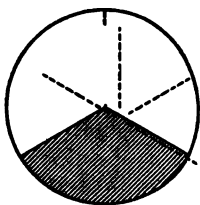
$$\frac{1}{2}$$



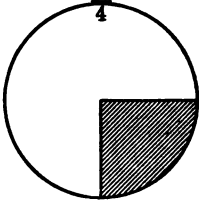
$$\frac{1}{4}$$



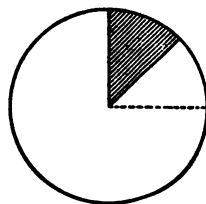
$$\frac{1}{3}$$



$$\frac{1}{6}$$

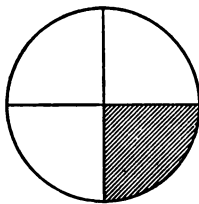


$$\frac{1}{4}$$

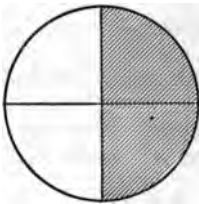


$$\frac{1}{8}$$

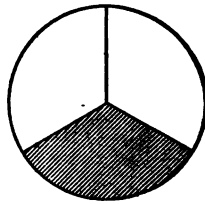
6. Compare $\frac{1}{2}$ and $\frac{1}{4}$.
7. Compare $\frac{1}{3}$ and $\frac{1}{6}$.
8. Compare $\frac{1}{4}$ and $\frac{1}{8}$.
9. If the denominator be doubled (*e.g.* $2 \times 3 = 6$) how will the value of the fraction be affected?



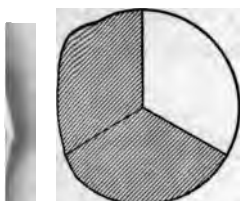
$$\frac{1}{4}$$



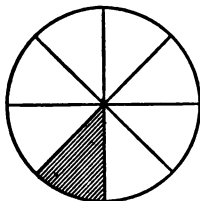
$$\frac{2}{4}$$



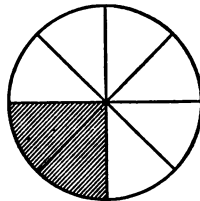
$$\frac{1}{3}$$



$$\frac{2}{8}$$



$$\frac{1}{8}$$



$$\frac{2}{8}$$

The Numerator

1. Compare $\frac{1}{4}$ and $\frac{2}{4}$.
2. Compare $\frac{1}{3}$ and $\frac{2}{3}$.
3. Compare $\frac{1}{8}$ and $\frac{2}{8}$.
4. If the numerator be doubled, how will the value of the fraction be affected?

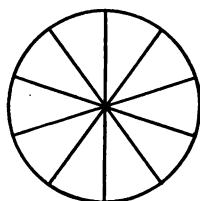
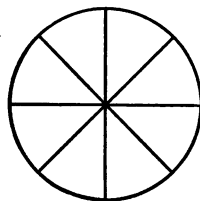
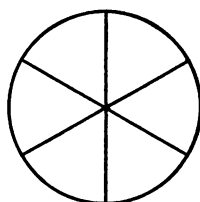
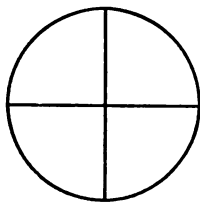
Changing Fractions to Higher Terms

1. How many fourths in $\frac{1}{2}$?

2. How many sixths in $\frac{1}{2}$?

3. How many eighths in $\frac{1}{2}$?

4. How many tenths in $\frac{1}{2}$?



If we write the answers in a table, we have :

A. $\frac{1}{2} = \frac{2}{4}$. Compare the two denominators

C. $\frac{1}{2} = \frac{4}{8}$.

B. $\frac{1}{2} = \frac{3}{6}$. and the two numerators.

D. $\frac{1}{2} = \frac{5}{10}$.

We might have obtained these results (without using pictures) by multiplying both the numerator and the denominator of $\frac{1}{2}$ by the same number.

$$\frac{1}{2} = \frac{2 \times 1}{2 \times 2} = \frac{2}{4}$$

$$\frac{1}{2} = \frac{4 \times 1}{4 \times 2} = \frac{4}{8}$$

$$\frac{1}{2} = \frac{3 \times 1}{3 \times 2} = \frac{3}{6}$$

$$\frac{1}{2} = \frac{5 \times 1}{5 \times 2} = \frac{5}{10}$$

This operation is called **the reduction of fractions to higher terms**.

In $\frac{1}{2} = \frac{3}{6}$, the new numerator 3 is “higher” (or greater) than the old numerator, and the new denominator 6 is “higher” (or greater) than the old denominator.

By changing the numerator from 1 to 3, we get 3 times as many parts; but at the same time we change the denominator from 2 to 6, so that the parts are only one third as large. The change in the numerators is offset or balanced by the change in the denominators.

PRINCIPLE. Multiplying both terms of a fraction by the same number does not change the value of the fraction.

ORAL EXERCISE

$$\frac{1}{6} = \frac{?}{12}$$

1. What number must 6 be multiplied by to produce 12?

2. What operation must be performed on the numerator to keep the value of the fraction unchanged?

3. Reduce $\frac{1}{6}$ to twelfths.

SOLUTION

EXPLANATION

$$\frac{1}{6} = \frac{2}{12} \text{ Ans.}$$

To make the denominator 12, we must multiply the 6 by 2; multiplying both terms by 2, we have

$$\frac{2 \times 1}{2 \times 6} = \frac{2}{12} \text{ Ans.}$$

WRITTEN EXERCISE

4. Reduce to twelfths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{6}{6}$.
5. Reduce to fifteenths: $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{5}$.
6. Change to sixteenths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, $\frac{8}{8}$.

ORAL EXERCISE

7. Remembering $\frac{1}{6} = \frac{2}{12}$, tell how many twelfths in $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{6}{6}$.
8. How many twelfths in $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$?
9. How many twelfths in $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{4}{4}$?
10. How many tenths in $\frac{1}{5}$? In $\frac{2}{5}$? In $\frac{3}{5}$? In $\frac{4}{5}$? In $\frac{5}{5}$?

Reduction of Fractions to Lower Terms

TO THE TEACHER.—This lesson may be postponed until addition and subtraction of fractions shall have been taught.

$$\frac{1}{2} = \frac{2}{4}$$

When we change $\frac{1}{2}$ to $\frac{2}{4}$, we reduce $\frac{1}{2}$ to higher terms.

$$\frac{2}{4} = \frac{1}{2}$$

When we change $\frac{2}{4}$ to $\frac{1}{2}$, we reduce $\frac{2}{4}$ to lower terms.

$\frac{1}{2} = \frac{2 \times 1}{2 \times 2} = \frac{2}{4}$ To change $\frac{1}{2}$ to higher terms, we multiply the numerator and the denominator.

$\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}$ To change $\frac{2}{4}$ to lower terms, we divide the numerator and the denominator by 2.

PRINCIPLE. Dividing both terms of a fraction by the same number does not change the value of the fraction.

1. Reduce $\frac{4}{6}$ to lower terms.

$\frac{4}{6} = \frac{4 \div 2}{6 \div 2} = \frac{2}{3}$ Divide both terms of $\frac{4}{6}$ by 2. The answer is $\frac{2}{3}$.

2. Write these fractions in a column and reduce each of them to lower terms: $\frac{6}{8}, \frac{4}{10}, \frac{2}{12}, \frac{8}{10}, \frac{10}{12}, \frac{6}{10}$.

Sometimes we cannot exactly divide both terms by 2; so we try 3, 5, 7 or some larger whole number.

3. Reduce $\frac{9}{12}$ to lower terms.

$\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$ Divide both terms by 3. The answer is $\frac{3}{4}$.

4. Write these fractions in a column and reduce each of them to lower terms: $\frac{3}{9}, \frac{3}{15}, \frac{5}{10}, \frac{6}{9}, \frac{10}{15}, \frac{15}{20}, \frac{6}{15}, \frac{12}{15}, \frac{14}{21}$.

Sometimes we can reduce a fraction to lower terms more than once.

5. Reduce $\frac{6}{12}$ to lower terms.

$$\frac{6}{12} = \frac{6 \div 2}{12 \div 2} = \frac{3}{6}$$

Dividing both terms by 2,
we get $\frac{3}{6}$.

$$\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2} \text{ Ans.}$$

Dividing both terms by 3,
we get $\frac{1}{2}$.

But we may save time by dividing by the largest exact divisor of both terms.

$$\frac{6}{12} = \frac{6 \div 6}{12 \div 6} = \frac{1}{2} \text{ Ans.}$$

6 is the largest exact divisor of 6 and 12; dividing both terms by 6, we get $\frac{1}{2}$.

When both terms cannot be exactly divided by the same whole number, the fraction is in its lowest terms.

When $\frac{6}{12}$ is changed to $\frac{3}{6}$, it is reduced to lower terms.

When $\frac{6}{12}$ is changed to $\frac{1}{2}$, it is reduced to its lowest terms.

WRITTEN EXERCISE

Reduce to lowest terms:

1. $\frac{6}{12}$.

7. $\frac{12}{30}$.

13. $\frac{16}{56}$.

19. $\frac{50}{68}$.

2. $\frac{9}{12}$.

8. $\frac{25}{30}$.

14. $\frac{36}{54}$.

20. $\frac{21}{72}$.

3. $\frac{3}{18}$.

9. $\frac{9}{36}$.

15. $\frac{12}{56}$.

21. $\frac{15}{88}$.

4. $\frac{15}{18}$.

10. $\frac{18}{36}$.

16. $\frac{15}{60}$.

22. $\frac{30}{90}$.

5. $\frac{9}{24}$.

11. $\frac{11}{44}$.

17. $\frac{22}{60}$.

23. $\frac{42}{96}$.

6. $\frac{18}{24}$.

12. $\frac{21}{48}$.

18. $\frac{42}{60}$.

24. $\frac{75}{100}$.

Addition of Fractions of the Same Denominator

WRITTEN EXERCISE

Find sums; if the answers are improper fractions, reduce them to mixed numbers; reduce *all* fractions (in the answers) to lowest terms:

1. $\frac{1}{2} + \frac{3}{2} + \frac{1}{2} + \frac{5}{2}$.

9. $\frac{1}{6} + \frac{5}{6} + \frac{7}{6} + \frac{4}{6} + \frac{3}{6}$.

2. $\frac{1}{4} + \frac{3}{4} + \frac{1}{4} + \frac{3}{4} + \frac{2}{4}$.

10. $\frac{7}{8} + \frac{5}{8} + \frac{3}{8} + \frac{1}{8} + \frac{9}{8}$.

3. $\frac{1}{5} + \frac{2}{5} + \frac{3}{5}$.

11. $\frac{4}{5} + \frac{4}{5} + \frac{4}{5}$.

4. $\frac{5}{6} + \frac{5}{6} + \frac{1}{6}$.

12. $\frac{3}{4} + \frac{3}{4} + \frac{3}{4}$.

5. $\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{7}{8}$.

13. $\frac{3}{8} + \frac{3}{8} + \frac{3}{8}$.

6. $\frac{9}{10} + \frac{5}{10} + \frac{7}{10}$.

14. $\frac{5}{6} + \frac{5}{6} + \frac{5}{6} + \frac{5}{6}$.

7. $\frac{4}{5} + \frac{6}{5} + \frac{3}{5} + \frac{7}{5}$.

15. $\frac{5}{8} + \frac{5}{8} + \frac{5}{8} + \frac{5}{8}$.

8. $\frac{2}{3} + \frac{4}{3} + \frac{1}{3} + \frac{10}{3}$.

16. $\frac{5}{12} + \frac{5}{12} + \frac{5}{12} + \frac{5}{12}$.

Addition of Fractions

ORAL PROBLEMS

1. One morning a grocer sold $3\frac{1}{2}$ lb. of sugar to Mrs. Brown and $3\frac{1}{2}$ lb. to Mrs. Smith. How many pounds did he sell to both?

2. He sold $3\frac{1}{4}$ lb. of butter to Mrs. Brown and $2\frac{3}{4}$ lb. to Mrs. Smith. How many pounds of butter did he sell to both?

3. He sold $\frac{3}{8}$ lb. of pepper to Mrs. Brown and $\frac{3}{8}$ lb. to Mrs. Smith. How much pepper did he sell to both?

4. He sold $2\frac{1}{4}$ lb. of coffee to Mrs. Brown and $3\frac{1}{4}$ lb. to Mrs. Smith. How much coffee did he sell to both?

5. He sold $2\frac{1}{8}$ lb. of cheese to Mrs. Brown and $1\frac{7}{8}$ lb. to Mrs. Smith. How much cheese did he sell to both?

WRITTEN PROBLEMS

1. A dry goods merchant sold to one customer $12\frac{3}{4}$ yd. of silk.; to another, $8\frac{1}{4}$ yd.; and to a third customer, $25\frac{3}{4}$ yd. How many yards did he sell to the three customers?

2. He sold one morning the following amounts of linen: $8\frac{1}{8}$ yd., $15\frac{3}{8}$ yd., $26\frac{5}{8}$ yd., $9\frac{7}{8}$ yd. How many yards did he sell in all?

3. He paid one month for rent $\$62\frac{1}{4}$, for lighting $\$14\frac{3}{4}$, for heating $\$9\frac{3}{4}$, and for wages $\$76\frac{3}{4}$. What was his total expenditure for these items?

4. One day he sold the following amounts of broadcloth: $18\frac{3}{8}$ yd., $21\frac{5}{8}$ yd., $6\frac{3}{8}$ yd., $9\frac{7}{8}$ yd., $1\frac{1}{8}$ yd., $12\frac{1}{8}$ yd. How many yards in all did he

" "

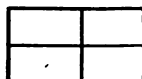
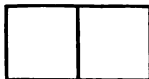
Addition of Fractions: Common Denominator Given

Review carefully pages 149 to 151.

1. Add
- $\frac{1}{2}$
- and
- $\frac{1}{4}$
- .

Solution:

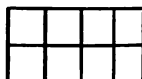
$$\frac{1}{2} = \frac{2}{4}; \quad \frac{2}{4} + \frac{1}{4} = \frac{3}{4}.$$



2. Add
- $\frac{1}{4}$
- and
- $\frac{3}{8}$
- .

Solution:

$$\frac{1}{4} = \frac{2}{8}; \quad \frac{2}{8} + \frac{3}{8} = \frac{5}{8}.$$

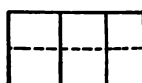


3. Add
- $\frac{1}{2}$
- and
- $\frac{1}{3}$
- .

Solution:

$$\frac{1}{2} = \frac{3}{6}; \quad \frac{1}{3} = \frac{2}{6};$$

$$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}.$$

In example 1, we changed $\frac{1}{2}$ to $\frac{2}{4}$ before adding to $\frac{1}{4}$.In example 2, we changed $\frac{1}{4}$ to $\frac{2}{8}$ before adding to $\frac{3}{8}$.In example 3, we changed $\frac{1}{2}$ to $\frac{3}{6}$ and $\frac{1}{3}$ to $\frac{2}{6}$ before adding.**Before adding fractions, we must change them to the same denominator. This denominator is called the *common denominator*.****WRITTEN EXERCISE**

1. Reduce to eighths:
- $\frac{1}{2}$
- ,
- $\frac{1}{4}$
- ,
- $\frac{3}{4}$
- .

Arrange your work in this way: $\frac{1}{2} = \frac{4}{8}$

$$\frac{1}{4} = \frac{2}{8}$$

$$\frac{3}{4} = \frac{6}{8}$$

2. Change to twelfths:
- $\frac{1}{2}$
- ,
- $\frac{2}{3}$
- ,
- $\frac{3}{4}$
- .

3. Reduce to eighths and add:
- $\frac{3}{4}$
- ,
- $\frac{3}{8}$
- .

4. Change to twelfths and add: $\frac{1}{3}, \frac{5}{12}$.
5. Reduce to tenths and add: $\frac{2}{5}, \frac{7}{10}$.
6. Reduce to ninths and add: $\frac{2}{3}, \frac{5}{9}$.

You have been able to add these fractions because in each example the common denominator has been told to you.

Addition of Fractions: One Reduction

ORAL EXERCISE

Add $\frac{1}{4}$ and $\frac{5}{8}$.

To add these fractions, we must find the common denominator of fourths and eighths. We first try the larger denominator; 8 is the common denominator, because 4 is an exact divisor of 8.

SOLUTION

$$\begin{array}{r} \frac{1}{4} = \frac{2}{8} \\ \frac{5}{8} = \frac{5}{8} \\ \hline \frac{7}{8} \end{array} \text{ Ans.}$$

EXPLANATION

$$\frac{1}{4} = \frac{2}{8}; \quad \frac{2}{8} + \frac{5}{8} = \frac{7}{8} \quad \text{Ans.}$$

WRITTEN EXERCISE

Add:

Find sums:

- | | | |
|--------------------------------------|------------------------------------|------------------------------------|
| 1. $\frac{1}{4}$ and $\frac{3}{8}$. | 6. $\frac{3}{4} + \frac{1}{8}$. | 11. $\frac{5}{6} + \frac{1}{12}$. |
| 2. $\frac{1}{2}$ and $\frac{1}{8}$. | 7. $\frac{1}{4} + \frac{5}{12}$. | 12. $\frac{3}{4} + \frac{1}{12}$. |
| 3. $\frac{1}{3}$ and $\frac{1}{6}$. | 8. $\frac{7}{12} + \frac{1}{6}$. | 13. $\frac{1}{6} + \frac{1}{2}$. |
| 4. $\frac{1}{3}$ and $\frac{5}{9}$. | 9. $\frac{1}{3} + \frac{7}{12}$. | 14. $\frac{1}{3} + \frac{5}{12}$. |
| 5. $\frac{2}{3}$ and $\frac{1}{6}$. | 10. $\frac{2}{3} + \frac{1}{12}$. | 15. $\frac{4}{6} + \frac{1}{10}$. |

ORAL EXERCISE

Add $\frac{3}{4}$ and $\frac{5}{12}$.

SOLUTION

$$\frac{3}{4} = \frac{9}{12}$$

$$\frac{5}{12} = \frac{5}{12}$$

$$\frac{14}{12} = 1\frac{2}{12} = 1\frac{1}{6} \text{ Ans.}$$

EXPLANATION

12 is the common denominator, because 4 is an exact divisor of 12. $\frac{3}{4} = \frac{9}{12}$; $\frac{9}{12} + \frac{5}{12} = \frac{14}{12}$. Reducing $\frac{14}{12}$ to a mixed number, we have $1\frac{1}{6}$ or $1\frac{1}{6}$. *Ans.*

WRITTEN EXERCISE

1. Find sums: $\frac{3}{4} + \frac{7}{8}$; $\frac{2}{3} + \frac{5}{6}$; $\frac{5}{6} + \frac{7}{12}$; $\frac{7}{9} + \frac{2}{3}$; $1\frac{1}{2} + \frac{1}{2}$.

2. Add: $\frac{2}{3}$ and $\frac{7}{12}$; $\frac{1}{2}$ and $\frac{5}{8}$; $\frac{1}{3}$ and $\frac{5}{6}$; $\frac{3}{5}$ and $\frac{7}{10}$; $\frac{4}{5}$ and $\frac{3}{10}$.

Addition of Fractions: Two Reductions

Add $\frac{3}{4}$ and $\frac{5}{6}$.

SOLUTION

$$\frac{3}{4} = \frac{9}{12}$$

$$\frac{5}{6} = \frac{10}{12}$$

$$\frac{19}{12} = 1\frac{7}{12} \text{ Ans.}$$

EXPLANATION

We must find the common denominator of fourths and sixths.

Try 6; 6 is not the common denominator because 4 is not an exact divisor of 6.

Try 2 times 6, or 12; 12 is the common denominator because 4 is an exact divisor of 12.

Reduce $\frac{2}{3}$ and $\frac{3}{4}$ to a common denominator.

SOLUTION

EXPLANATION

$\frac{2}{3} = \frac{8}{12}$ 4 is not the common denominator; 2×4
 $\frac{3}{4} = \frac{9}{12}$ is not the common denominator; 3×4
 is the common denominator;

$$\frac{2}{3} = \frac{8}{12}; \quad \frac{3}{4} = \frac{9}{12}.$$

The numbers 4, 8, 12, 16, etc., are called **multiples** of 4, because they are obtained from 4 by multiplying, 1×4 , 2×4 , etc., respectively.

To find the least common denominator of two or more fractions, we find that smallest multiple of one denominator which is a multiple of the others also. We try in turn each of the multiples of the largest denominator until we find one which is a multiple of the other denominators also; *e.g.*, in the above example, 4 is the larger denominator; its multiples are 4, 8, 12, 16, 20, etc. Try each multiple to see if it is a multiple of the other denominator (3). Is 4 a multiple of 3? No. Is 8 a multiple of 3? No. Is 12 a multiple of 3? Yes.

The letters l. c. d. are an abbreviation for "least common denominator."

WRITTEN EXERCISE

1. Add: $\frac{2}{3}$ and $\frac{3}{4}$; $\frac{2}{3}$ and $\frac{1}{4}$; $\frac{3}{4}$ and $\frac{1}{6}$; $\frac{1}{2}$ and $\frac{3}{5}$; $\frac{1}{3}$ and $\frac{2}{5}$.

2. Find sums: $\frac{2}{5} + \frac{3}{4}$; $\frac{1}{8} + \frac{1}{6}$; $\frac{5}{8} + \frac{5}{6}$; $\frac{3}{5} + \frac{5}{6}$; $\frac{4}{5} + \frac{1}{4}$.

Addition : Three or More Reductions

1. Add $\frac{2}{3}, \frac{1}{4}, \frac{5}{6}, \frac{7}{8}$. To find the l. c. d., try 8, 16, 24, etc.
 8 is a multiple of 4, but not of 3 or of 6;
 16 is a multiple of 4, but not of 3 or of 6;
 24 is a multiple of 4, 3, and 6.
 24 is the l. c. d.

2. Add $\frac{2}{3}, \frac{4}{5}, \frac{5}{6}, \frac{9}{10}$. To find the l. c. d., try 10, 20, 30.

Find sums :

Add :

3. $\frac{1}{2} + \frac{2}{3} + \frac{5}{9}$.

6. $\frac{1}{3}, \frac{3}{4}, \frac{1}{6}, \frac{11}{12}$.

4. $\frac{2}{3} + \frac{3}{4} + \frac{1}{6}$.

7. $\frac{5}{8}, \frac{7}{12}, \frac{3}{4}$.

5. $\frac{7}{9} + \frac{5}{6} + \frac{1}{3}$.

8. $\frac{3}{4}, \frac{1}{2}, \frac{5}{7}$.

WRITTEN EXERCISE

1. Add
- $25\frac{5}{8}, 109\frac{5}{6}, 70\frac{1}{3}$
- .

You may arrange your work in this way :

$$\begin{array}{r} 20\frac{5}{8} = 20\frac{15}{24} \\ 109\frac{5}{6} = 109\frac{20}{24} \\ 70\frac{1}{3} = 70\frac{8}{24} \\ \hline 199\frac{43}{24} = 200\frac{19}{24} \end{array}$$

Or you may arrange your work in this way :

$$\begin{array}{r} 24 \\ 20\frac{5}{8} \quad \overline{15} \\ 109\frac{5}{6} \quad 20 \\ 70\frac{1}{3} \quad 8 \\ \hline 199 \quad \frac{43}{24} = 200\frac{19}{24} \end{array}$$

2. Add $19\frac{1}{2}$, $25\frac{2}{3}$, $8\frac{1}{4}$. 5. Add $50\frac{1}{6}$, $67\frac{7}{10}$, $29\frac{1}{2}$, $12\frac{3}{8}$
 3. Add $20\frac{1}{3}$, $45\frac{2}{5}$, $6\frac{1}{6}$. 6. Add $256\frac{5}{12}$, $158\frac{1}{3}$, $247\frac{1}{2}$.
 4. Add $6\frac{1}{4}$, $10\frac{1}{2}$, $7\frac{4}{5}$. 7. Add 300 , $27\frac{3}{10}$, $155\frac{5}{8}$, $40\frac{3}{5}$

Addition of Fractions

WRITTEN PROBLEMS

1. In furnishing his home, a man used $30\frac{1}{4}$ yd. of carpet for the sitting room, $18\frac{1}{2}$ yd. for the hall, and $26\frac{5}{8}$ yd. for his bedroom. How many yards in all did he use?

2. A *poultry dealer* sold to Mrs. Brown five chickens weighing respectively as follows: $2\frac{3}{8}$ lb., $3\frac{1}{4}$ lb., $1\frac{7}{8}$ lb., $3\frac{5}{8}$ lb., $2\frac{1}{2}$ lb. What was the *total* weight of the five chickens?

3. A *dairyman* sold eggs to Mrs. Smith as follows: Monday $1\frac{1}{2}$ doz., Tuesday $\frac{2}{3}$ doz., Wednesday $\frac{5}{8}$ doz., Thursday $1\frac{1}{4}$ doz., Friday 0, Saturday $1\frac{3}{4}$ doz. How many dozen eggs did Mrs. Smith buy from the dairyman?

4. A girl used $\frac{1}{3}$ yd. of *ruching* on the neck of her dress and $\frac{1}{4}$ yd. on each cuff. How much did she use all together?

5. On a running track having 4 laps to the mile, a boy ran the first lap in $2\frac{1}{8}$ min., second lap $2\frac{1}{2}$ min., third lap $3\frac{3}{8}$ min., fourth lap $3\frac{3}{4}$ min. How long did he take to run the whole mile?

Subtraction of Fractions

REVIEW EXERCISE

Find remainders; reduce answers to lowest terms:

1. $\frac{3}{4} - \frac{1}{4}$.

5. $\frac{7}{8} - \frac{3}{8}$.

9. $\frac{9}{4} - \frac{3}{4}$.

2. $\frac{5}{8} - \frac{3}{8}$.

6. $\frac{11}{12} - \frac{5}{12}$.

10. $\frac{7}{8} - \frac{5}{8}$.

3. $\frac{5}{6} - \frac{1}{6}$.

7. $\frac{4}{3} - \frac{1}{3}$.

11. $\frac{7}{12} - \frac{5}{12}$.

4. $\frac{9}{12} - \frac{5}{12}$.

8. $\frac{8}{9} - \frac{2}{9}$.

12. $\frac{14}{15} - \frac{2}{15}$.

Subtraction: Easy Fractions

1. Subtract $\frac{5}{8}$ from $\frac{3}{4}$.

The l. c. d. is 8. $\frac{3}{4} = \frac{6}{8}$; $\frac{6}{8} - \frac{5}{8} = \frac{1}{8}$ *Ans.*

2. Subtract $\frac{5}{8}$ from $\frac{5}{6}$.

The l. c. d. is 24. $\frac{5}{6} = \frac{20}{24}$; $\frac{5}{8} = \frac{15}{24}$; $\frac{20}{24} - \frac{15}{24} = \frac{5}{24}$ *Ans.*

EXERCISE

First Time Written; Second Time Oral

3. Subtract $\frac{3}{4}$ from $\frac{11}{12}$; from $\frac{5}{6}$; from $\frac{4}{5}$.

Find remainders:

4. $\frac{9}{10} - \frac{1}{2}$.

8. $\frac{5}{8} - \frac{1}{3}$.

12. $\frac{9}{10} - \frac{4}{5}$.

5. $\frac{4}{5} - \frac{1}{3}$.

9. $\frac{5}{6} - \frac{3}{8}$.

13. $\frac{4}{5} - \frac{1}{6}$.

6. $\frac{5}{9} - \frac{1}{3}$.

10. $\frac{3}{4} - \frac{2}{5}$.

14. $20 - \frac{5}{12}$.

7. $\frac{3}{4} - \frac{2}{5}$.

11. $\frac{11}{12} - \frac{3}{4}$.

15. $40 - \frac{4}{5}$.

ORAL PROBLEMS

1. A boy has $\frac{1}{2}$ mi. to walk; he rests after he has walked $\frac{1}{3}$ mi. How much farther has he to walk?

2. A boy had $\frac{4}{5}$ of a dollar; he spent $\frac{1}{2}$ of a dollar. How much did he have left?

3. A girl bought $\frac{7}{8}$ yd. of lace. How much did she have left after using $\frac{2}{3}$ yd.?

4. A grocer poured out $\frac{1}{5}$ gal. of cider from a jug holding $\frac{3}{4}$ gal. How much was left in the jug?

5. I have $\frac{3}{4}$ of an hour to wait for a train. If I use $\frac{1}{3}$ of an hour to write a letter, what part of an hour shall I still have to wait?

Subtraction: Mixed Numbers

1. Subtract $12\frac{3}{4}$ from $18\frac{5}{6}$.

You may arrange your work according to either model:

$$18\frac{5}{6} = 18\frac{10}{12}$$

$$12\frac{3}{4} = 12\frac{9}{12}$$

$$6\frac{1}{12} \text{ Ans.}$$

12

$$\begin{array}{r} 18\frac{5}{6} \\ 12\frac{3}{4} \end{array} \begin{array}{|l} 10 \\ 9 \end{array}$$

$$6 \frac{1}{12} \text{ Ans.}$$

Find remainders:

2. $10\frac{2}{3} - 7\frac{1}{4}$.

6. $\frac{7}{8} - \frac{2}{3}$.

3. $4\frac{5}{8} - 2\frac{1}{2}$.

7. $3\frac{5}{6} - 2\frac{1}{3}$.

4. $67\frac{11}{12} - 42\frac{3}{4}$.

8. $1\frac{5}{8} - \frac{1}{3}$.

5. $24\frac{3}{4} - \frac{2}{3}$.

9. $10\frac{1}{2} - 4\frac{2}{3}$.

ORAL EXERCISE

From $8\frac{2}{5}$ take $5\frac{3}{5}$.

Arrange your work according to either model:

$$\begin{array}{r} 8\frac{2}{5} = 8\frac{2}{5} \\ 5\frac{3}{5} = 5\frac{10}{15} \\ \hline 2\frac{14}{15} \text{ Ans.} \end{array} \qquad \begin{array}{r} 15 \\ 8\frac{2}{5} \overline{) 9} \\ 5\frac{3}{5} \overline{) 10} \\ \hline 2 \quad \frac{14}{15} \text{ Ans.} \end{array}$$

EXPLANATIONS. You cannot take $\frac{10}{15}$ from $\frac{2}{15}$. You may, however, do one of two things:

1. In the minuend take 1 unit from the 8 units, change the 1 unit into $\frac{15}{15}$, add to it the $\frac{2}{15}$, making the minuend $7\frac{17}{15}$, and then subtract $5\frac{10}{15}$ from $7\frac{17}{15}$, getting $2\frac{14}{15}$ for the answer.

Or 2. You may use the method of "making change." Subtract $5\frac{10}{15}$ from the 8 units in the minuend, leaving $2\frac{2}{15}$; add to this remainder the $\frac{2}{15}$ of the minuend, getting the final remainder $2\frac{14}{15}$. Or you may say: 10 from 15 leaves 5; 5 and 9 are 14; write down $\frac{14}{15}$; 5 from 7 leaves 2; write down 2.

WRITTEN EXERCISE

Find remainders:

1. $12\frac{1}{2} - 8\frac{5}{8}$.
2. $50\frac{1}{2} - 34\frac{5}{8}$.
3. $6\frac{3}{4} - 2\frac{7}{8}$.
4. $11\frac{2}{5} - 7\frac{1}{2}$.
5. $26\frac{2}{3} - 9\frac{3}{4}$.
6. $14\frac{1}{4} - 4\frac{1}{5}$.
7. $180\frac{1}{9} - 175\frac{1}{3}$.
8. $21\frac{3}{8} - 14\frac{7}{12}$.
9. $98\frac{2}{3} - 12\frac{4}{5}$.
10. $76\frac{3}{4} - 16\frac{5}{6}$.

WRITTEN PROBLEMS

1. If I cut off $3\frac{2}{3}$ yd. from a piece of cloth $22\frac{3}{4}$ yd. long, how many yards will remain in the piece?

2. A dealer bought a horse for $\$87\frac{1}{2}$; he sold it for $\$105\frac{1}{4}$. How much did he gain?

3. In a journey of $15\frac{1}{2}$ mi., I traveled by wagon $9\frac{5}{8}$ mi. and walked the remaining distance. How far did I walk?

4. A tub when filled with butter weighs $70\frac{3}{8}$ lb.; when empty, it weighs $3\frac{3}{4}$ lb. How much butter does it hold?

5. A mechanic earns $\$21\frac{3}{4}$ a week; his weekly expenses are $\$14\frac{3}{5}$. How much can he save?

Addition and Subtraction of Fractions

One Operation

SIGHT EXERCISE

1. $\frac{1}{2} + \frac{3}{4} = ?$

6. $\frac{7}{8} - \frac{1}{4} = ?$

11. $\frac{7}{10} - \frac{2}{5} = ?$

2. $\frac{3}{4} + \frac{3}{8} = ?$

7. $\frac{3}{4} - \frac{1}{2} = ?$

12. $\frac{4}{5} - \frac{1}{4} = ?$

3. $\frac{3}{4} - \frac{3}{8} = ?$

8. $\frac{2}{3} + \frac{1}{4} = ?$

13. $\frac{5}{16} - \frac{1}{4} = ?$

4. $\frac{5}{6} - \frac{1}{2} = ?$

9. $\frac{5}{6} + \frac{1}{3} = ?$

14. $\frac{3}{10} - \frac{1}{5} = ?$

5. $\frac{2}{3} - \frac{1}{4} = ?$

10. $\frac{4}{9} - \frac{1}{3} = ?$

15. $\frac{1}{4} - \frac{1}{6} = ?$

ORAL EXERCISE

1. Add $\frac{2}{3}$ and $\frac{1}{4}$.
2. Take $\frac{1}{3}$ from $\frac{3}{4}$.
3. How much is $\frac{5}{8} + \frac{1}{3}$?
4. From $\frac{5}{9}$ take $\frac{1}{3}$.
5. How much is $\frac{1}{2}$ increased by $\frac{2}{3}$?
6. Find the sum of $\frac{5}{9}$ and $\frac{2}{3}$.
7. Subtract $\frac{5}{12}$ from $\frac{5}{6}$.
8. Add $\frac{2}{5}$ and $\frac{1}{3}$.
9. How much is $\frac{3}{4} - \frac{1}{6}$?
10. Add $2\frac{1}{3}$ and $1\frac{1}{4}$.

ORAL PROBLEMS

1. A stick is $\frac{1}{2}$ yd. long. If $\frac{1}{3}$ yd. be cut off, how long will the remainder be?
2. A piece of *bunting* is $\frac{7}{8}$ yd. long. If another piece $\frac{3}{4}$ yd. long be stitched to it, how long will the entire piece be?
3. A can of corn weighed $\frac{3}{4}$ lb.; the empty can weighed $\frac{3}{16}$ lb. How much corn did the can contain?
4. A dressmaker used $\frac{7}{8}$ yd. of ribbon on a waist; she had left $\frac{1}{4}$ yd. How long was the piece at first?
5. From $\frac{8}{9}$ of a yard of ribbon, I cut off $\frac{1}{3}$ of a yard. What part of a yard was left?

WRITTEN EXERCISE

Find sums:

$$\begin{array}{r} 1. \quad 8\frac{1}{3} \\ 12\frac{1}{2} \\ \underline{10\frac{5}{6}} \end{array}$$

$$\begin{array}{r} 2. \quad 7\frac{3}{4} \\ 19\frac{2}{3} \\ \underline{7\frac{1}{2}} \end{array}$$

$$\begin{array}{r} 3. \quad 15\frac{1}{3} \\ 6\frac{5}{6} \\ \underline{9\frac{2}{3}} \end{array}$$

$$\begin{array}{r} 4. \quad 16\frac{1}{2} \\ 20\frac{5}{8} \\ \underline{4\frac{3}{4}} \end{array}$$

$$\begin{array}{r} 5. \quad 18\frac{5}{9} \\ 6\frac{1}{3} \\ \underline{47\frac{2}{9}} \end{array}$$

$$\begin{array}{r} 6. \quad 18\frac{1}{4} \\ 12\frac{1}{2} \\ \underline{5\frac{5}{6}} \end{array}$$

$$\begin{array}{r} 7. \quad 46\frac{3}{8} \\ 25\frac{1}{6} \\ \underline{7\frac{3}{4}} \end{array}$$

$$\begin{array}{r} 8. \quad 16\frac{2}{5} \\ 24\frac{1}{3} \\ \underline{10\frac{4}{15}} \end{array}$$

Find remainders:

$$\begin{array}{r} 1. \quad 12\frac{1}{2} \\ 9\frac{5}{6} \\ \underline{} \end{array}$$

$$\begin{array}{r} 2. \quad 26\frac{1}{8} \\ 24\frac{1}{3} \\ \underline{} \end{array}$$

$$\begin{array}{r} 3. \quad 17\frac{5}{8} \\ 9\frac{1}{3} \\ \underline{} \end{array}$$

$$\begin{array}{r} 4. \quad 56\frac{5}{8} \\ 47\frac{5}{8} \\ \underline{} \end{array}$$

$$\begin{array}{r} 5. \quad 92\frac{1}{2} \\ 76\frac{2}{3} \\ \underline{} \end{array}$$

$$\begin{array}{r} 6. \quad 64\frac{2}{5} \\ 28\frac{1}{4} \\ \underline{} \end{array}$$

$$\begin{array}{r} 7. \quad 50\frac{3}{5} \\ 25\frac{1}{6} \\ \underline{} \end{array}$$

$$\begin{array}{r} 8. \quad 20\frac{4}{5} \\ 7\frac{1}{2} \\ \underline{} \end{array}$$

9-16. Find the sum of the numbers given in each example, 1 to 8.

WRITTEN PROBLEMS

1. A tea merchant sold 3 chests of tea weighing respectively as follows: $52\frac{5}{8}$ lb., $57\frac{7}{8}$ lb., $49\frac{1}{2}$ lb. Find the total weight.

2. A grocer bought 3 sacks of coffee weighing respectively $64\frac{3}{4}$ lb., $68\frac{5}{8}$ lb., $72\frac{1}{2}$ lb. What was the entire weight of the 3 sacks?

3. A cask of vinegar holding $15\frac{1}{4}$ gal. was broken while being carted. Upon delivery it was found to hold only $9\frac{7}{8}$ gal. How many gallons were lost?

4. It took a man $3\frac{1}{5}$ hr. to climb a mountain and $1\frac{2}{3}$ hr. to descend. How long did the entire trip take if he rested $\frac{3}{4}$ of an hour at the top of the mountain?

5. On December 1, a farmer's woodpile measured $756\frac{1}{3}$ cu. yd.; and on January 1 following, it measured $596\frac{3}{4}$ cu. yd. How many cubic yards of wood were used during the month of December?

Addition and Subtraction of Fractions

One or Two Operations

SIGHT EXERCISE

NOTE.—Perform the operations in the order in which they are written.

$$1. \frac{1}{2} + \frac{1}{4} - \frac{1}{8} = ?$$

$$6. \frac{5}{9} + \frac{2}{3} - \frac{2}{9} = ?$$

$$2. \frac{3}{4} + \frac{1}{2} - \frac{1}{8} = ?$$

$$7. \frac{3}{4} + \frac{1}{3} - \frac{1}{4} = ?$$

$$3. \frac{1}{4} + \frac{1}{2} - \frac{3}{8} = ?$$

$$8. \frac{5}{6} + \frac{2}{3} - \frac{1}{6} = ?$$

$$4. \frac{7}{8} + \frac{1}{4} - \frac{1}{2} = ?$$

$$9. \frac{3}{4} + \frac{3}{5} = ?$$

$$5. \frac{5}{6} + \frac{1}{3} - \frac{1}{2} = ?$$

$$10. 1\frac{1}{2} - \frac{4}{5} = ?$$

ORAL PROBLEMS

1. I had $1\frac{1}{2}$ yd. of ribbon; I cut off $\frac{1}{2}$ yd. and $\frac{1}{3}$ yd. How much did I have left?

2. I had $\frac{7}{8}$ of an acre of land; I sold $\frac{1}{2}$ A. and $\frac{1}{4}$ A. What part of an acre was left?

3. I had $\$ \frac{3}{4}$ and gave $\$ \frac{2}{5}$ for a knife. How much money had I left?

4. If $\frac{1}{3}$ and $\frac{1}{4}$ be added to a certain fraction, the sum will be 1. What is the fraction?

5. I bought a knife for $\$ \frac{1}{2}$ and sold it for $\$ \frac{2}{5}$. How much money did I lose by the *transaction*?

Find the missing numbers:

1. $9\frac{1}{3}$ $12\frac{1}{2}$ + ? <hr style="width: 100%;"/> 25 $\frac{1}{4}$	2. $10\frac{3}{4}$ $4\frac{5}{8}$ + ? <hr style="width: 100%;"/> 20	3. $6\frac{1}{5}$ $8\frac{2}{3}$ + ? <hr style="width: 100%;"/> 27 $\frac{1}{5}$	4. $16\frac{2}{3}$ $24\frac{1}{4}$ + ? <hr style="width: 100%;"/> 75 $\frac{1}{6}$
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WRITTEN PROBLEMS

1. From a plot of land containing $204\frac{1}{2}$ A., the following *parcels* were sold: To Mr. A, $32\frac{1}{4}$ A.; to Mr. B, $16\frac{2}{3}$ A.; to Mr. C, $65\frac{3}{10}$ A. How many acres remained unsold?

2. An automobile traveled 70 mi. in 3 hr.; in the first hour it went $29\frac{3}{8}$ mi.; in the second hour, $24\frac{3}{4}$ mi. How far did it travel in the third hour?

a. From a piece of silk measuring $45\frac{1}{2}$ yd., a merchant sold $18\frac{3}{4}$ yd. to one customer and $24\frac{1}{4}$ yd. to another. How many yards remained?

c. A man works $9\frac{1}{2}$ hr. and sleeps $7\frac{1}{2}$ hr. during the day. How much time is otherwise employed?

n. A tailor bought a piece of cloth containing $14\frac{1}{2}$ yd. He used $2\frac{1}{2}$ yd. for a coat, $\frac{1}{2}$ yd. for a vest, and $1\frac{1}{4}$ yd. for trousers. How many yards were left?

Fractional Parts of Integers

Review pages 175 to 199, Part I

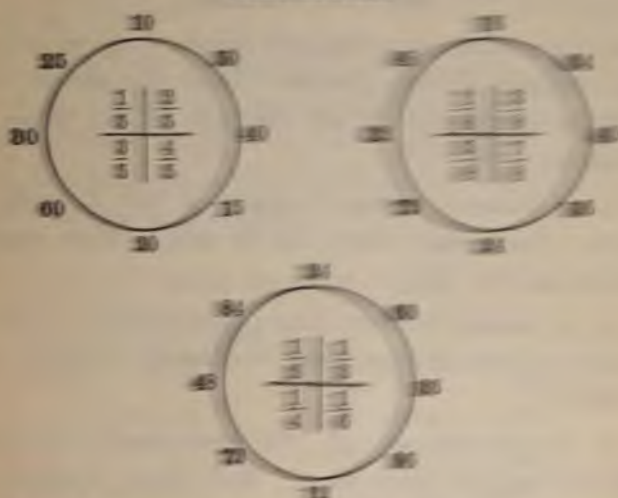
SIGHT EXERCISE

1. Find $\frac{1}{2}$ of 20, 24, 18, 36, 48, 40, 50.
2. Find $\frac{1}{3}$ of 12, 24, 30, 24, 36, 48, 75.
3. Find $\frac{1}{4}$ of 12, 24, 20, 32, 28, 40, 60, 80, 100.
4. Find $\frac{1}{5}$ of 20, 40, 35, 60, 75, 100.
5. Find $\frac{1}{6}$ of 36, 24, 18, 42, 48, 60, 72, 90, 120.
6. Find $\frac{1}{8}$ of 48, 24, 64, 80, 40, 96, 76, 160.
7. Find $\frac{1}{2}$ of 39, 27, 25, 63, 75, 49, 37, 81, 101, 151.

ORAL EXERCISE

1. Think $\frac{1}{3}$ of 12; find $\frac{2}{3}$ of 12.
2. Think $\frac{1}{4}$ of 20; find $\frac{3}{4}$ of 20.
3. Think $\frac{1}{8}$ of 32; find $\frac{3}{8}$ of 32; $\frac{5}{8}$ of 32; $\frac{7}{8}$ of 32.
4. Think $\frac{1}{6}$ of 48; find $\frac{5}{6}$ of 48.
5. Think $\frac{1}{5}$ of 30; find $\frac{2}{5}$ of 30; $\frac{3}{5}$ of 30.

ORAL DRILL



These diagrams are to be copied on the blackboard. The teacher will point first to the fraction, then to the integer. The pupils should give the answers either orally or in writing without hesitation.

WRITTEN EXERCISE

- Find $\frac{2}{3}$ of 690, of 870, of 720, of 834, of 1125.
- Find $\frac{3}{5}$ of 800, of 960, of 730, of 1650, of 2875.
- Find $\frac{2}{5}$ of 1256, of 960, of 784, of 384, of 35,488.
- Find $\frac{5}{8}$ of \$16.50, of \$7.80, of \$35.70, of \$127.80.
- Find $\frac{7}{8}$ of \$ of \$63.28, of of \$114, of \$218.
- Find $\frac{1}{2}$ of \$1 Find $\frac{1}{3}$ of of $\frac{1}{5}$.

3. From a piece of silk measuring $45\frac{1}{4}$ yd., a merchant sold $18\frac{3}{8}$ yd. to one customer and $24\frac{3}{4}$ yd. to another. How many yards remained?

4. A man works $9\frac{1}{3}$ hr., and sleeps $7\frac{1}{2}$ hr. during the day. How much time is otherwise employed?

5. A tailor bought a piece of cloth containing $14\frac{1}{4}$ yd. He used $2\frac{1}{3}$ yd. for a coat, $\frac{5}{8}$ yd. for a vest, and $1\frac{1}{4}$ yd. for trousers. How many yards were left?

Fractional Parts of Integers

Review pages 175 to 199, Part I

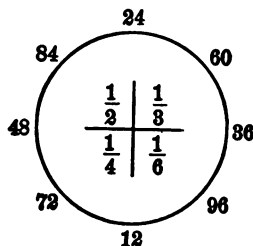
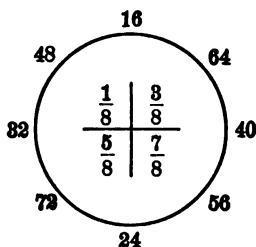
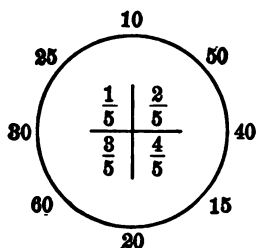
SIGHT EXERCISE

1. Find $\frac{1}{2}$ of 20, 24, 18, 36, 48, 40, 50.
2. Find $\frac{1}{3}$ of 12, 21, 30, 24, 36, 48, 75.
3. Find $\frac{1}{4}$ of 12, 24, 20, 32, 28, 40, 60, 80, 100.
4. Find $\frac{1}{5}$ of 20, 40, 35, 60, 75, 100.
5. Find $\frac{1}{6}$ of 36, 24, 18, 42, 48, 60, 72, 90, 120.
6. Find $\frac{1}{8}$ of 48, 24, 64, 80, 40, 96, 76, 160.
7. Find $\frac{1}{2}$ of 39, 27, 25, 63, 75, 49, 37, 81, 101, 151.

ORAL EXERCISE

1. Think $\frac{1}{3}$ of 12; find $\frac{2}{3}$ of 12.
2. Think $\frac{1}{4}$ of 20; find $\frac{3}{4}$ of 20.
3. Think $\frac{1}{8}$ of 32; find $\frac{3}{8}$ of 32; $\frac{5}{8}$ of 32; $\frac{7}{8}$ of 32.
4. Think $\frac{1}{6}$ of 48; find $\frac{5}{6}$ of 48.
5. Think $\frac{1}{5}$ of 30; find $\frac{2}{5}$ of 30; $\frac{3}{5}$ of 30; $\frac{4}{5}$ of 30.

ORAL DRILLS



These diagrams are to be copied on the blackboard. The teacher will point first to the fraction, then to the integer. The pupils should give the answers either orally or in writing without hesitation.

WRITTEN EXERCISE

- Find $\frac{2}{3}$ of 690, of 870, of 720, of 834, of 1125.
- Find $\frac{4}{5}$ of 800, of 965, of 730, of 1655, of 2875.
- Find $\frac{3}{8}$ of 1256, of 960, of 784, of 384, of 35,488.
- Find $\frac{5}{6}$ of \$16.50, of \$7.80, of \$35.70, of \$127.80.
- Find $\frac{7}{8}$ of \$42.40, of \$63.28, of \$576, of \$114, of \$218.
- Find $\frac{1}{2}$ of \$1; $\frac{1}{4}$; $\frac{3}{4}$. 7. Find $\frac{1}{3}$ of \$1; $\frac{2}{3}$; $\frac{5}{6}$; $\frac{7}{8}$.

WRITTEN PROBLEMS

1. One fifth of a flagpole 85 ft. long is below the surface of the ground. How far above the surface is the top of the flagpole, if the pole is standing erect?

2. A farmer owning a farm of 350 A. sold $\frac{2}{7}$ of it. How many acres did he sell? How many acres had he left?

3. A barrel of flour lasts a family 8 wk. How many pounds of flour does the family consume in 3 wk.?

4. A gardener set out 248 young trees. During the winter $\frac{1}{6}$ of them died. How many remained alive?

5. A clerk's income was \$ 1200 a year; he saved $\frac{3}{8}$ of it. How much did he save? How much did he spend?

6. A clerk's salary was \$ 900 a year. When promoted to a higher position, her salary was increased by $\frac{1}{4}$. What was her new salary?

7. A bicycle which cost \$ 80 was sold at a loss of $\frac{2}{5}$ of its cost. What was it sold for?

8. A dealer sold a horse which cost \$ 150 at a price which gave him a profit of $\frac{1}{5}$ of the cost. How much did he receive for the horse?

9. In 1906 a farmer's crop of corn averaged 21 bu. to the acre; in 1907 the average crop per acre

was $\frac{1}{3}$ greater. What was the average crop per acre in 1907?

10. In 1900 the population of a certain city was 12,450. In 1905 it was found that the population had increased by $\frac{1}{10}$ during the preceding 5 yr. What was the increase in numbers? What was the average increase in numbers for each year?

Aliquot Parts of a Dollar

Copy and memorize :

$\frac{1}{2}$ of \$1 = \$.50.	$\frac{1}{8}$ of \$1 = \$.12 $\frac{1}{2}$.
$\frac{1}{4}$ of \$1 = \$.25.	$\frac{3}{8}$ of \$1 = \$.37 $\frac{1}{2}$.
$\frac{3}{4}$ of \$1 = \$.75.	$\frac{5}{8}$ of \$1 = \$.62 $\frac{1}{2}$.
$\frac{1}{5}$ of \$1 = \$.20.	$\frac{7}{8}$ of \$1 = \$.87 $\frac{1}{2}$.

Multiplication by a Mixed Number

1. What is the cost of $7\frac{3}{4}$ lb. of butter at 40 ct. a pound?

PROCESS

EXPLANATION

\$.40	
<u>7$\frac{3}{4}$</u>	7 lb. cost 7×40 ct. = \$2.80
30	$\frac{3}{4}$ lb. costs $\frac{3}{4}$ of 40 ct. = .30
280	$7\frac{3}{4}$ lb. cost <u>\$3.10</u> Ans.
<u>\$3.10</u>	

2. How much will $8\frac{1}{4}$ yd. of cloth cost at 60 ct. a yard?

3. What must I pay for $15\frac{1}{2}$ yd. of carpet at \$2 a yard?

4. What should be the charge for a person boarding at a hotel for $4\frac{1}{2}$ da. at the rate of \$3 a day?

5. What price must be paid for $12\frac{1}{2}$ T. of coal at \$6 a ton?

6. If steak costs 20 ct. a pound, what is the cost of $5\frac{3}{4}$ lb.?

7. What charge should be made for $6\frac{1}{8}$ yd. of silk at \$1.60 a yard?

8. An automobile traveled $7\frac{3}{10}$ hr. at the speed of 40 mi. an hour. How far did it travel?

9. What must I pay for $9\frac{5}{8}$ bu. of potatoes at 80 ct. a bushel?

10. A carpenter worked $6\frac{3}{4}$ da. at a wage of \$4.80 a day. How much did he earn?

ORAL EXERCISE

1. Find the cost of $3\frac{1}{2}$ yd. of ribbon at 20 ct. a yard.

2. A boy worked $2\frac{1}{2}$ da. at the rate of 50 ct. a day. How much did he earn?

3. How far shall I travel in 4 hr. if I walk at the rate of $2\frac{1}{2}$ mi. an hour?

4. What is the charge for $2\frac{1}{4}$ da. board at \$2 a day?

5. Find the cost of $1\frac{3}{4}$ lb. of beefsteak at 24 ct. a pound.

WRITTEN EXERCISE

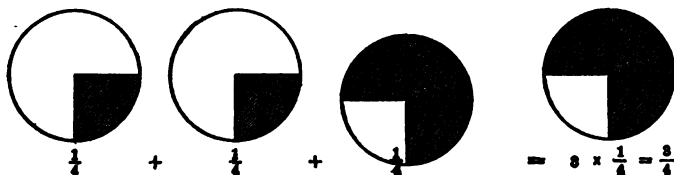
1. Multiply 28 by $3\frac{1}{4}$.
2. Multiply 36 by $12\frac{1}{2}$.
3. What is the product of 150 by $15\frac{3}{5}$?
4. What is the product of \$3.84 by $16\frac{2}{3}$?

Find products:

- | | |
|-------------------------------------|-------------------------------------|
| 5. $14\frac{5}{6} \times \$12.60$. | 9. $3\frac{3}{4} \times \$2.20$. |
| 6. $8\frac{1}{2} \times 274$. | 10. $4\frac{4}{5} \times \$1.60$. |
| 7. $10\frac{1}{3} \times 567$. | 11. $6\frac{2}{3} \times \$18.90$. |
| 8. $18\frac{3}{4} \times \$4.80$. | 12. $12\frac{3}{7} \times \$21$. |

A Fractional Unit multiplied by an Integer

ORAL EXERCISE



1. How much is $\$ \frac{1}{2} + \$ \frac{1}{2}$? How much is 2 times $\$ \frac{1}{2}$?
2. How much is $\frac{1}{3} + \frac{1}{3}$? How much is 2 times $\frac{1}{3}$?
3. How much is 2 times $\frac{1}{4}$? $2 \times \frac{1}{5}$? $2 \times \frac{1}{6}$? $2 \times \frac{1}{8}$?

4. How much is $\$ \frac{1}{2} + \$ \frac{1}{2} + \$ \frac{1}{2}$? How much is 3 times $\$ \frac{1}{2}$?

5. How much is 3 times $\frac{1}{3}$? $3 \times \frac{1}{4}$? $3 \times \frac{1}{5}$? $3 \times \frac{1}{6}$?

6. How much is $4 \times \frac{1}{2}$? $4 \times \frac{1}{3}$? $4 \times \frac{1}{5}$? $4 \times \frac{1}{6}$? $4 \times \frac{1}{8}$?

7. Find the product of $10 \times \frac{1}{2}$; $10 \times \frac{1}{5}$; $10 \times \frac{1}{3}$; $10 \times \frac{1}{4}$; $10 \times \frac{1}{8}$; $10 \times \frac{1}{6}$; $10 \times \frac{1}{7}$; $10 \times \frac{1}{10}$.

ORAL PROBLEMS

1. What will 2 books cost at $\$ \frac{1}{2}$ apiece? At 50 ct. apiece?

2. What will 3 circus tickets cost at $\$ \frac{1}{2}$ each? At $\$ \frac{1}{4}$ each?

3. Find the cost of 8 yd. of ribbon at 50 ct. a yard. (Hint: 50 ct. = $\$ \frac{1}{2}$.)

4. What must I pay for 12 pk. of potatoes at 25 ct. a peck?

5. What will the grocer charge for 16 doz. eggs at 50 ct. a dozen?

6. How far can a boy row a boat in 30 min., if he takes 10 min. to row it $\frac{1}{3}$ of a mile?

7. Find the cost of 20 books @ (= at) 25 ct. each.

3 times $\$1\frac{1}{2}$, etc.

EXERCISE

First Time Written; Second Time Oral

1. What will 3 books cost @ \$1 each? At 50 ct. each? At \$1.50 each?

SOLUTION. $\$1.50 = \$1\frac{1}{2}$. At \$1 each, 3 books would cost \$3; at $\$ \frac{1}{2}$ each, 3 books would cost $\$1\frac{1}{2}$; at $\$1\frac{1}{2}$ each, 3 books would cost $\$3 + \$1\frac{1}{2}$ or \$4.50.

2. What will 5 books cost @ \$1.50 each?

3. What will 4 yd. of cloth cost @ \$1.50 a yard?

4. Find the cost of 8 yd. @ \$1.50 a yard; of 6 yd.; of 7 yd.; of 10 yd.; of 9 yd.

5. What will 3 books cost @ \$1.25 each?

SOLUTION. $\$1.25 = \$1\frac{1}{4}$. At \$1 each, 3 books would cost \$3; at $\$ \frac{1}{4}$ each, 3 books would cost $\$ \frac{3}{4}$; at $\$1\frac{1}{4}$ each, 3 books would cost $\$3 + \$ \frac{3}{4}$ or \$3.75.

6. What will 4 books cost @ \$1.25 each? 8 books? 6 books? 7 books? 5 books? 10 books? 9 books?

7. How much must I pay for 7 yd. of gingham, which is selling at the rate of $12\frac{1}{2}$ ct. a yard?

8. How much should a boy receive for picking fruit for 6 da. at the rate of $\$1.12\frac{1}{2}$ a day?

9. A *liveryman* charged a doctor \$1.20 an hour for the use of a carriage. What was the charge for 7 hr.?

WRITTEN EXERCISE

1. What will 27 dictionaries cost at \$10.25 each?

SOLUTION

$$\begin{aligned}
 \$10.25 &= \$10\frac{1}{4} \\
 27 \times \frac{1}{4} &= 6\frac{3}{4} \\
 27 \times 10 &= 270 \\
 \$270 + \$6\frac{3}{4} &= \$276\frac{3}{4}
 \end{aligned}$$

ARRANGEMENT

$$\begin{array}{r}
 \$10\frac{1}{4} \\
 27 \\
 \hline
 6\frac{3}{4} \\
 270 \\
 \hline
 \$276\frac{3}{4}, \text{ or } \$276.75 \text{ Ans.}
 \end{array}$$

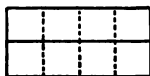
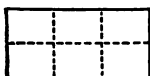
2. I bought 40 yd. of carpet at \$2.25 a yard. What was the amount of my *bill*?

3. What is the proper charge for 5 days' board, at the rate of \$2.50 a day?

4. A farmer agreed to sell 100 A. of his land at the price of \$62.50 an acre. How much should he receive?

5. A clerk's daily expenses averaged \$2.12 $\frac{1}{2}$ a day. What were his expenses for 30 da.?

The Fractional Unit



In the pictures we see units of the same size divided into halves, thirds, fifths, sixths, and eighths respectively.

We may, if we wish, regard as the unit, one of the parts into which the whole has been divided. In

Figure I, $\frac{1}{2}$ may be regarded as the unit; then the *original* unit is twice as large as the new unit, that is, $\frac{1}{2} + \frac{1}{2} = 1$ or $2 \times \frac{1}{2} = 1$. The new unit is called the *fractional unit*.

In Figure II, $\frac{1}{3}$ is the fractional unit; and the original unit is 3 times the fractional unit.

1. What is the fractional unit in Figure III? In Figure IV? In Figure V? Make drawings showing 3 other fractional units, being careful to have the original units of the same size.

2. Write all the fractional units from $\frac{1}{2}$ to $\frac{1}{10}$.

3. What number is always the numerator of a fractional unit?

A fractional unit is one of the parts into which a unit is divided equally.

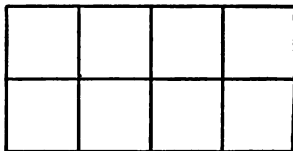
4. Copy Figure I, and draw lines that will change the fractional unit from $\frac{1}{2}$ to $\frac{1}{8}$.

5. Suppose that we wish to change the fractional unit in Figure IV. How many sixths must we group together to make the fractional unit $\frac{1}{3}$? How many to make it $\frac{1}{2}$?

COMPARISONS — Halves, Fourths, Eighths

1. How many eighths in $\frac{1}{2}$? In $\frac{1}{4}$? In $\frac{3}{4}$?

2. How many fourths in $\frac{1}{2}$? In $\frac{3}{4}$?



3. What is $\frac{1}{2}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{4}$?
4. What part of $\frac{1}{2}$ is $\frac{1}{4}$? Of $\frac{1}{2}$ is $\frac{1}{8}$? Of $\frac{1}{4}$ is $\frac{1}{8}$?
5. $\frac{1}{4}$ is what part of $\frac{1}{2}$? Of $\frac{3}{4}$?
6. $\frac{1}{8}$ is what part of $\frac{1}{2}$? Of $\frac{3}{4}$? Of $\frac{3}{8}$? Of $\frac{5}{8}$?
7. $\frac{3}{4}$ is how many times $\frac{1}{8}$?

Halves, Thirds, Sixths

8. What is $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{2}{3}$?
9. How many sixths in $\frac{1}{3}$? In $\frac{1}{2}$? In $\frac{2}{3}$? In $\frac{5}{6}$?
10. $\frac{1}{6}$ is what part of $\frac{1}{3}$? Of $\frac{1}{2}$? Of $\frac{5}{6}$? Of $\frac{2}{3}$?

Thirds and Ninths

11. What is $\frac{1}{3}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{2}{3}$? $\frac{1}{3}$ of $\frac{6}{9}$? $\frac{1}{2}$ of $\frac{8}{9}$?

12. How many ninths in $\frac{1}{3}$? In $\frac{2}{3}$?

13. $\frac{1}{9}$ is what part of $\frac{1}{3}$? Of $\frac{2}{3}$? Of $\frac{4}{9}$? Of $\frac{8}{9}$? Of $\frac{4}{9}$?
14. $\frac{2}{3}$ is how many times $\frac{1}{9}$?

Thirds, Fourths, Sixths, Twelfths

15. What is $\frac{1}{3}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{3}{4}$?

16. What is $\frac{1}{3}$ of $\frac{2}{3}$? $\frac{1}{3}$ of $\frac{3}{12}$? $\frac{1}{6}$ of $\frac{1}{2}$? $\frac{1}{6}$ of $\frac{12}{12}$?

17. How many twelfths in $\frac{1}{2}$? In $\frac{1}{3}$? In $\frac{1}{4}$?
In $\frac{1}{6}$? In $\frac{2}{3}$? In $\frac{3}{4}$? In $\frac{5}{6}$?

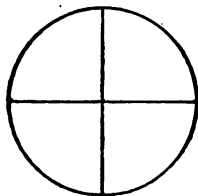
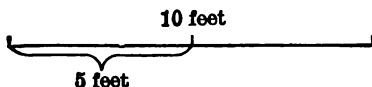
18. What part of $\frac{1}{2}$ is $\frac{1}{6}$? Of $\frac{1}{3}$ is $\frac{1}{6}$? Of $\frac{2}{3}$ is $\frac{1}{6}$?
Of $\frac{5}{6}$ is $\frac{1}{6}$?

19. What part of $\frac{3}{4}$ is $\frac{1}{2}$? Of $\frac{1}{2}$ is $\frac{1}{3}$? Of $\frac{1}{2}$ is $\frac{1}{4}$?

20. How many times $\frac{1}{6}$ is $\frac{1}{3}$? How many times
 $\frac{1}{6}$ is $\frac{1}{2}$?

21. How many times $\frac{1}{12}$ is $\frac{1}{6}$?

**Finding the Value of the Whole when the Value of
One Part is Given**



1. If $\frac{1}{2}$ of a bean pole measures 5 ft., how long is the whole pole?

2. If $\frac{1}{3}$ of the width of a room is 10 ft., how many feet are in the entire width of the room?

3. If $\frac{1}{4}$ of a pie costs 5 ct., what is the whole pie worth?

4. What will a barrel of flour cost, if $\frac{1}{3}$ of a barrel costs \$3?

5. If a boy can run 200 yd. in $\frac{1}{2}$ min., how far can he run in a minute at the same rate?

6. How long will a ton of coal last a family if they use $\frac{1}{2}$ ton in 12 da.?

7. John is 7 yr. old ; his age is $\frac{1}{3}$ of Mary's age. How old is Mary?

8. If 3 pt. of water runs out of a faucet in $\frac{1}{6}$ min., how much will run out in 1 min.?

9. If $\$ \frac{1}{4}$ will buy 3 cigars, how many will \$1 buy?

10. If $\frac{1}{3}$ of a number is 5, what is the number?

11. 10 is $\frac{1}{5}$ of what number?

12. What number is 7 the fourth of?

Find the cost of:

1. A yard of ribbon, when $\frac{1}{2}$ yd. costs 10 ct.

2. A peck of potatoes, when $\frac{1}{2}$ pk. costs 20 ct.

3. A gallon of molasses, when $\frac{1}{4}$ gal. costs 9 ct.

4. A pound of butter, when $\frac{1}{4}$ lb. costs 8 ct. .

5. A cord of wood, when $\frac{1}{3}$ cd. costs \$4.

6. A dozen eggs, when $\frac{1}{3}$ doz. costs 12 ct.

7. A pound of pepper, when $\frac{1}{8}$ lb. costs 5 ct

How many will \$1 buy:

1. If $\$ \frac{1}{8}$ buys 4 writing pads?

2. If $\$ \frac{1}{2}$ buys 4 doz. pencils?

3. If $\$ \frac{1}{4}$ buys 2 collars?

4. If $\$ \frac{1}{3}$ buys 8 cakes of soap?

5. If $\$ \frac{1}{5}$ buys 10 boxes of matches?

WRITTEN PROBLEMS

1. One half of the length of the tennis court is 39 ft. How many feet in its entire length?

2. Half of William's kite string measured 57 ft. How long was the entire string?

3. A man poured 18 qt. of maple sirup into his kettle and found that the kettle was then $\frac{1}{3}$ full. How many quarts would the kettle hold when full?

4. A man received \$65 for his horse, which was $\frac{1}{4}$ of what he paid for it. How much did the horse cost him?

5. I spent $\frac{1}{2}$ of my money and I have left \$3.75. How much did I have at first?

6. In one year a man saved \$265, which was $\frac{1}{5}$ of what he earned. How much did he earn?

7. A teacher *distributed* among her pupils 32 pencils, which was $\frac{1}{6}$ of her entire supply. How large was her supply?

8. A child's heart beats 24 times in $\frac{1}{4}$ of a minute. How many times does it beat in a minute?

9. I drew out of the bank \$134, which was $\frac{1}{10}$ of my entire deposit. What was my deposit?

$$\frac{1}{2} \text{ of } \frac{2}{3} = \frac{1}{3}, \text{ etc.}$$

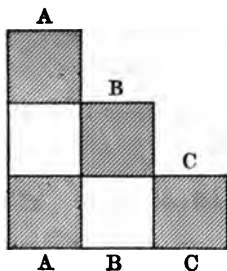


FIG. I

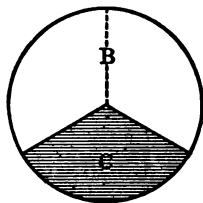


FIG. II

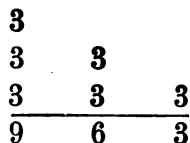


FIG. III

1. Looking at Figure I: If A is one unit, how much is C ? How much is B ?

2. If B is one unit, how much is C ?

3. If B is $\frac{2}{3}$, how much is C ?

4. How much is $\frac{1}{2}$ of $\frac{2}{3}$?

NOTE TO TEACHER. — Pupils should be required to answer such a question in a complete sentence; e.g. $\frac{1}{2}$ of $\frac{2}{3}$ is (or "equals") $\frac{1}{3}$; or, $\frac{1}{3}$ is (or "equals") $\frac{1}{2}$ of $\frac{2}{3}$.

5. Looking at Figure II: How much is C ? How much is B ?

6. B is how many times as large as C ? C is how large compared to B ?

7. How much is $\frac{1}{2}$ of $\frac{2}{3}$?

8. Looking at Figure III: 3 is $\frac{1}{3}$ of how many?

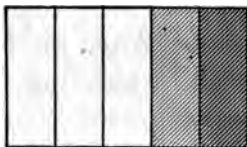
9. 6 is $\frac{2}{3}$ of how many? 3 is $\frac{1}{2}$ of how many?

10. How much is $\frac{1}{2}$ of $\frac{2}{3}$ of 9?

11. $\frac{1}{2}$ of 6 is $\frac{1}{3}$ of how many?
 12. How much is $\frac{1}{2}$ of 2? $\frac{1}{3}$ of 3? $\frac{1}{4}$ of 4 yd.? $\frac{1}{5}$ of \$5?
 13. How much is $\frac{1}{2}$ of 2 thirds? $\frac{1}{2}$ of 2 fourths? $\frac{1}{2}$ of $\frac{2}{3}$?

Draw diagrams showing the fractional units equivalent to the following:

1. $\frac{1}{2}$ of $\frac{2}{3}$ = ? 5. $\frac{1}{5}$ of $\frac{5}{6}$ = ?
 2. $\frac{1}{3}$ of $\frac{3}{4}$ = ? 6. $\frac{1}{3}$ of $\frac{3}{8}$ = ?
 3. $\frac{1}{4}$ of $\frac{4}{5}$ = ? 7. $\frac{1}{4}$ of $\frac{4}{6}$ = ?
 4. $\frac{1}{2}$ of $\frac{2}{4}$ = ? 8. $\frac{1}{5}$ of $\frac{5}{8}$ = ?



Finding the Value of the Whole when the Value of a Fractional Part is Given

1. Looking at Figure I, page 184: If B measures 8 sq. in., how much does, C measure? How much does A measure?

2. Looking at Figure II: If the area of B is 10 sq. in., what is the area of C ? Of the whole circle?

3. If $\frac{3}{4}$ of a pie costs 15 ct., what will $\frac{1}{4}$ cost? What will the whole pie cost?

SOLUTION

$\frac{3}{4}$ costs 15 ct.
 $\frac{1}{4}$ costs $\frac{1}{3}$ of 15 ct. = 5 ct.
 $\frac{1}{4}$ costs 4×5 ct. = 20 ct. *Ans.*

EXPLANATION

Since $\frac{3}{4}$ costs 15 ct., $\frac{1}{4}$ costs $\frac{1}{3}$ of 15 ct. or 5 ct., and $\frac{1}{4}$, or the whole, costs 4 times 5 ct. or 20 ct.

4. If $\frac{2}{3}$ of a cord of wood costs \$10, what will a cord cost?
5. What is the cost of a yard of ribbon, when $\frac{3}{4}$ yd. costs 12 ct.?
6. If $\frac{2}{5}$ of a line measures 4 in., how long is $\frac{1}{5}$ of the line? How long is the whole line?
7. If $\frac{3}{8}$ of a plot of land contains 15 A., how many acres are there in the whole plot?
8. When the plot was sold, \$200 was paid in cash, which was $\frac{2}{5}$ of the price. What was the whole price?
9. What is the price of a dozen eggs, when $\frac{2}{3}$ doz. costs 16 ct.?
10. 12 is $\frac{2}{3}$ of what number?

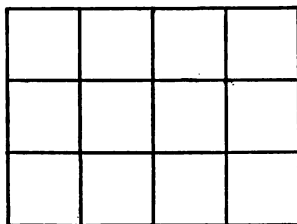
WRITTEN EXERCISE

1. 10 is $\frac{2}{7}$ of what number?
2. 30 is $\frac{3}{5}$ of what number?
3. 50 is $\frac{5}{6}$ of what number?
4. 100 is $\frac{2}{3}$ of what number?
5. \$2.10 is $\frac{3}{8}$ of what amount?
6. $\frac{9}{10}$ of ? = 54.
7. \$16.50 is $\frac{3}{4}$ of what amount?
8. \$45.50 is $\frac{5}{12}$ of what amount?
9. 36 qt. are $\frac{4}{5}$ of how many quarts?
10. \$7.20 is $\frac{3}{10}$ of what amount?

Finding what Fraction One Number is of Another Number

NOTE TO TEACHER.—Questions should be answered in complete sentences.

1. How many squares in the whole oblong?
2. How many in $\frac{1}{2}$ of the oblong? In $\frac{1}{3}$ of the oblong? In $\frac{1}{4}$ of the oblong?



3. 6 squares are what part of 12 squares?
4. 4 squares are what part of 12 squares?
5. What part of 12 squares are 3 squares? 2 squares? 9 squares? 8 squares? 10 squares?
6. What part of 12 squares is 1 square? 2 squares? 3 squares? 5 squares? 7 squares? 9 squares? 11 squares?
7. What part of 6 squares are 3 squares? 2 squares? 4 squares? 1 square? 5 squares?
8. 6 squares are what part of 8 squares? Of 9 squares? Of 10 squares?

ORAL EXERCISE

What part:

1. Of 7 is 5? Of 8 is 3? Of 9 is 6? Of 10 is 7? Of 16 is 12?

2. Of 25 is 15? Of 40 is 20? Of 50 is 25?
Of 100 is 50? Of 24 is 18?

3. Of 8 is 7? Of 16 is 15? Of 16 is 14? Of
20 is 1? Of 20 is 19?

ORAL PROBLEMS

1. 3 qt. are what part of 2 gal.?
2. 2 ft. are what part of 2 yd.?
3. 50 ct. are what part of \$2?
4. A cent is what part of a dime?
5. 75 ct. are what part of \$1?
6. 12 oz. are what part of a pound?
7. What part of my money did I spend if I spent 30 ct. out of the 50 ct. which I had?
8. A pole 20 ft. long is standing upright in water 8 ft. deep. What part of the pole is in the water?
9. I used 9 sheets of paper out of a quire I had bought. What part of the quire did I use?

WRITTEN PROBLEMS

1. In a class of 32 pupils, 8 are boys. What fraction of the class are the boys?
2. A steamship starts on a journey of 3000 mi.; it goes 600 mi. the first day. What part of the journey was covered on that day?

3. On a farm of 160 A., 60 A. were planted with wheat. What part of the whole farm was the wheat field?

4. Out of 4 doz. eggs 16 were spoiled. What part of the lot was spoiled?

5. A clerk earning \$28 a week pays \$12 a week for board. What part of his wages is paid for board?

6. What part of the day is given to work by a man who works 10 hr. a day?

7. A cook uses 12 oz. of sugar in making a cake weighing 3 lb. What part of the cake consists of sugar?

8. What fractional part of a barrel of flour has been consumed if the remainder weighs 147 lb.?

9. If mustard costs 32 ct. a pound, what part of a pound can be bought for 20 ct.?

10. How much velvet worth \$2.50 a yard can I buy for \$1?

11. To make a suit of clothes valued at \$30, a tailor spends \$6 for material and \$9 for labor. What part of the value is paid for material and labor?

12. What part of a mile does a boy run in racing 440 yd.?

13. What part of a dozen eggs may be bought for 30 ct. when the price is 36 ct. a dozen?

BILLS AND RECEIPTS

I

CLEVELAND, O., May 3, 1909.

MR. SAMUEL BLACK

614 Euclid Ave.

Bought of CONSUMERS' MILK CO.

158 Euclid Ave.

Apr.		62	Bottles Fluid Milk @ 9¢	5	58
		45	Bottles Cream @ 12¢	5	40
		10	Bottles Buttermilk @ 7¢		70
				11	68

Received payment for Consumers' Milk Co.,
May 6, 1909.

A. DUNBAR.

Make out a similar bill for 37 bottles of milk,
26 bottles of cream, and 12 bottles of buttermilk.

II

BUFFALO, N. Y., Dec. 12, 1908.

MR. GEORGE RICE

125 Delaware Ave.

Bought of HULL, GUPPEN & CO.

HARDWARE

HEATING, PLUMBING, GAS FITTING, AND
CONTRACTORS' SUPPLIES

208 Main Street

1	Set Grate Bars for Furnace	6	00		
1	Sheet Tin		10		
3	Bolts		10		
10	lb. Cement	1	00		
1	Grate Complete for Hot-water Heater	2	00		
1	Shaker		50		
	Wire		15		
	Nails		05		
	Candles		15		
14	Hours' Time, Man and Helper	11	90		
				21	95

Paid, Dec. 18, 1908,

HULL, GUPPEN & Co.,

per P. STANLEY.

III

MR. JOHN K. CARR
19 Montgomery St.

To CONSOLIDATED GAS COMPANY OF NEW YORK, *Dr.*

Branch Office, 157 Grand St.

For gas supplied from Nov. 13 to Dec. 15, 1908		
Present state of meter 18,000		
Previous state of meter 11,800		
To supply of 6200 cu. ft. of gas at \$.80 per M	4	96

Received payment, Jan. 2, 1909

..... for the Company.

PROBLEMS

1. James Smith bought to-day from R. T. Wilson, grocer : 6 lb. cheese @ $12\frac{1}{2}$ ct. per pound ; 2 lb. tea @ 55 ct. per pound ; 2 jars molasses @ 14 ct. per jar. Make out the bill and receipt.

2. Copy the following bill. Put in date, name, business, and address of some dealer you know. Make the bill against yourself.

-----19-----

M-----

To-----, Grocer.

-----, Dr.

	2	lb. Powdered Sugar @	.71½	
	2	doz. Eggs @	.30	
	½	doz. Oranges @	.50	

Received payment, -----

3. Mr. James Grant, provision dealer, sends out weekly bills to his charge customers. Looking over his books, he found the following entries :

MR. J. L. SMITH

Mar. 7 5¼ lb. roast beef @ .16
 " 9 4 lb. chicken @ .22
 " 10 6½ lb. lamb @ .20

MRS. R. S. CASE

Mar. 7 3 lb. butter @ .38
 " 4 heads lettuce @ .05
 " 2½ lb. steak @ .18
 " 8 3 lb. sausages @ .15
 " 11 6¾ lb. roast beef @ .16

MR. H. LEVINNE

Mar. 7	8½ lb. chicken	@ .22
"	4 lb. butter	@ .38
"	2½ doz. eggs	@ .40
" 10	3 lb. steak	@ .18
" 11	2¼ lb. lamb chops	@ .16

Make out bills for the customers, filling them out, footing, and receipting them.

4. Suppose that you sold \$5 worth of groceries. Make out the itemized bill. (Inquire about prices at the nearest grocery store.)

5. Make out a bill of the milk and cream your mother buys in one month.

6. Mr. William Miles bought of R. H. Macy & Co., 34th St., New York: 1 rug @ \$12.50; 3 chairs @ \$3.75; 1 easy chair @ \$8.50; 1 bookcase @ \$7.50; 1 sofa @ \$11.25; 16 yd. muslin for curtains @ .23. What was the amount of the bill? Receipt.

7. On February 1, my gas meter indicated 11,200; on March 1, it indicated 15,600. What was the cost of the gas consumed during February, at \$1.25 per M?

8. Bought of Park and Tilford, New York, 1 bot. Olive Oil @ 70 ct.; ½ lb. White Pepper @ 44 ct.; 2 pkg. H-O @ 14 ct.; 2 jar Rasp. Jam @ 24 ct. Make out the bill and receipt it.

DECIMAL FRACTIONS

NOTE.—The class should read this section and do the exercises under the direction of the teacher, who may divide the section into lesson wholes. In preparation, review p. 3-7.

$\frac{1}{10} = .1$ $\frac{2}{10} = .2$ $\frac{1}{100} = .01$ $\frac{25}{100} = .25$ $\frac{1}{1000} = .001$ $\frac{45}{1000} = .045$ $\frac{625}{1000} = .625$	<p>What is each part called when a unit is divided into 10 equal parts?</p> <p>One tenth may be written in two ways: $\frac{1}{10}$ or .1.</p> <p>The period before the figure 1 is the decimal point.</p> <p>Read: $\frac{2}{10}$, .2, $\frac{5}{10}$, .5, .4, .7, .9.</p>
---	--

Write in both ways: 3 tenths,
6 tenths, 8 tenths.

The first place to the right of the decimal point is tenths' place.

What is each part called when a unit is divided into 100 equal parts? How many hundredths in 1 tenth?

Instead of "1 one hundredth," we say "1 hundredth."

One hundredth may be written $\frac{1}{100}$ or .01.

Read: $\frac{5}{100}$, .05, $\frac{7}{100}$, .07, .03, $\frac{25}{100}$, .25, $\frac{50}{100}$, .50.

Write in both ways: 9 hundredths, 15 hundredths, 35 hundredths, 10 hundredths.

The second place to the right of the decimal point is called hundredths' place.

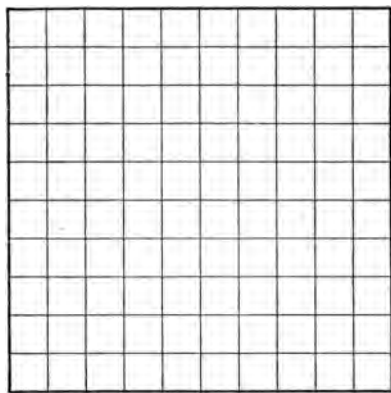
What is each part called when a unit is divided into 1000 equal parts?

One thousandth may be written in two ways: $\frac{1}{1000}$ or .001.

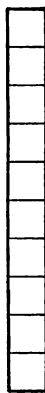
Read: $\frac{7}{1000}$, .007, $\frac{9}{1000}$, .009, $\frac{75}{1000}$, .075, .065, .095, .080, .257, .109, .750, .600.

The third place to the right of the decimal point is called thousandths' place.

Write in both ways: 4 thousandths, 24 thousandths, 75 thousandths, 475 thousandths, 60 thousandths, 150 thousandths, 500 thousandths, 5 thousandths.



A



B



C

In the picture if *A* is a unit, how much is *B*? How much is *C*?

If *C* were subdivided into 10 parts, what would each part be called?

How may a tenth be obtained from a unit?

How many hundredths in a unit?

How may a hundredth be obtained from a tenth?

How many thousandths in a unit?

How may a thousandth be obtained from a hundredth?

Fractions like $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, and their multiples, $\frac{2}{10}$, $\frac{57}{100}$, $\frac{278}{1000}$, etc., which are obtained by dividing and subdividing a unit by 10 repeatedly, may have their denominators indicated by means of the decimal point. The fractions written in this way are called **decimal fractions** or **decimals**; e.g. .5, .08, .025. Fractions whose denominators are written below the line are called **common fractions**; e.g. $\frac{5}{10}$, $\frac{8}{100}$, $\frac{25}{1000}$, $\frac{7}{8}$, $\frac{75}{100}$.

What fractions may be written both as common fractions and as decimals?

The figures 1, 2, 3, etc., to 9, represent numbers of objects from 1 to 9.

You have learned, however, that by means of the nine figures, 1, 2, 3, 4, etc., and the cipher, 0, any whole number (or "integer"), however large, may be written. We are able to write all these numbers with only ten characters because we give each character a *place value* besides its original value as a *counter* or *mark* for the numbers 1 to 9.

The numeral 2222 means 2 thousands + 2 hundreds + 2 tens + 2 units. The figure 2 has different values according to its place in the written numeral. The place values are called **orders**.

Name the orders in 39, in 456, in 2768.

Thousands— 1000 's ($10 \times 10 \times 10 \times 1$)
 Hundreds— 100 's ($10 \times 10 \times 1$)
 Tens— 10 's (10×1)
 Units— 1 's

3 7 6 5

The table represents the orders from units to thousands.

The orders proceed from right to left by multiples of 10, and they proceed from left to right by divisions of 10.

If we continue the orders to the left, what other orders shall we have?

If we wish to continue the orders to the right, we must divide by 10.

Dividing 1 by 10, we get $\frac{1}{10}$, .1.
 " $\frac{1}{10}$ by 10, " " $\frac{1}{100}$, .01.
 " $\frac{1}{100}$ by 10, " " $\frac{1}{1000}$, .001.

And so on.

The orders to the right of units represent fractions whose denominators are 10, or 10×10 , or $10 \times 10 \times 10$, and so on.

The decimal point separates the orders of whole numbers from the orders of decimal fractions.

Seven orders of whole numbers and three orders of decimal fractions are shown in the following table:

Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths
7	6	5	4	3	2	1	.	1	2	3

How many units in the number written? How many tens? How many tenths? How many of each of the other orders?

Read: .7, .07, .35, .006, .038, .105, .056, .090, .810, .400, .616, 616., .041.

20.45 is read "twenty *and* forty-five hundredths." The word "and" denotes the place of the decimal point.

Read: 16.5, 4.19, 63.63, 417.09, 2.02, 18.005, 645.048, 200.09, 856.1, 27.01.

Write:

- | | |
|---------------------|-----------------------------|
| 1. 427 thousandths. | 7. 125 thousandths. |
| 2. 8 tenths. | 8. 14 hundredths. |
| 3. 96 hundredths. | 9. 6 and 25 hundredths. |
| 4. 75 hundredths. | 10. 52 and 3 tenths. |
| 5. 6 tenths. | 11. 500 and 5 hundredths. |
| 6. 50 hundredths. | 12. 6000 and 6 thousandths. |

Suppose that Figure B, page 196, is the unit, what is each part called?

You have learned how to change fractions to higher terms. (See page 149.)

Change to tenths and write your answers as decimals:

$$\begin{array}{lll} \frac{1}{5} = \frac{2}{10} = .2 & \frac{3}{5} = & \frac{1}{2} = \\ \frac{2}{5} = & \frac{4}{5} = & \frac{5}{5} = \end{array}$$

Copy Figure B, page 196. Using B as a unit, show that your answers are correct.

Suppose that Figure A, page 196, is the unit, what is each part called?

Reduce the following fractions to hundredths, and write your answers as decimals:

$$\begin{array}{cccccc} \frac{1}{2} = ? & \frac{1}{5} = ? & \frac{4}{5} = ? & \frac{7}{10} = ? & \frac{1}{4} = ? & \frac{2}{5} = ? \\ \frac{1}{10} = ? & \frac{9}{10} = ? & \frac{3}{4} = ? & \frac{3}{5} = ? & \frac{3}{10} = ? & \frac{1}{10} = ? \end{array}$$

What does .25 mean? Why does \$.25 mean 25 ct.?

Why does \$ 1.50 mean 1 dollar and 50 ct.?

Why does \$ 3.36 mean 3 dollars and 36 ct.?

WRITTEN EXERCISE

1. Find the amount of \$ 14.36, \$ 19.84, \$ 165.79, and \$ 29.75.

2. Add 12.57 yd., 27.39 yd., 69.75 yd., and 106.50 yd.

Find sums:

3. 30.8	4. 5.23	5. 96.07	6. 1.12
17.5	7.09	10.5	8.9
61.2	6.35	109.42	9.08
<u>98.1</u>	<u>20.05</u>	<u>57.00</u>	<u>25.06</u>

MEASURES

REVIEW OF LIQUID MEASURE

ORAL EXERCISE

1. How many pints in a quart?
2. How many quarts in a gallon? In 10 gal.?
In 20 gal.? In 100 gal.?
3. How many pints in a gallon? In 5 gal.?
In 25 gal.? In 50 gal.?
4. At 4 ct. a pint, what will 5 qts. of milk cost?
5. How much must I pay for a gallon of molasses which sells at 10 ct. a pint?
6. How many quarts are there in 25 pts.?
7. When the price of vinegar is 24 ct. a gallon, how much will 3 pts. cost?
8. Cream costing 20 ct. a pint, what must I pay for a *gill*? (A gill is one fourth of a pint.)

4 gills = 1 pint

9. How many small pitchers of cream, each holding one gill, may be filled from a quart measure of cream?
10. How many quarts of cream are consumed daily by 200 people at a hotel, if each uses a gill of cream every day?

WRITTEN EXERCISE

A standard barrel contains $31\frac{1}{2}$ gallons.

1. How many gallons of water may be kept in a cistern whose capacity is 60 bbl.?

2. How much water will run out of a faucet in an hour's time, if the water runs at the rate of 3 pts. a minute?

3. A grocer bought a barrel of vinegar for \$3.50, and sold the vinegar for 10 ct. a quart. How much did he gain?

4. A milkman sells 188 quarts of milk at 8 ct. a quart and 60 pints of cream at 20 ct. a pint every day. How much money does he take in daily?

5. During the month of March, the milkman delivered to one customer 3 qts. of milk and a half pint of cream every day. At the same prices, what was the amount of the bill for the month?

REVIEW OF DRY MEASURE AND MEASURE OF WEIGHT

ORAL EXERCISE

1. How many quarts in a peck? In 5 pk.? In 25 pk.? In 100 pk.?

2. How many pecks in a bushel? In 10 bu.? In 25 bu.? In 100 bu.?

3. How many quarts in a bushel? In 3 bu.? In 10 bu.?

4. If a bushel of wheat weighs 60 lb., how much will 6 bu. weigh?

5. At ~~5~~ ct. a quart, what will a peck of potatoes cost?

6. At 10 ct. a quart, what will a half peck of apples cost?

7. How many ounces in a pound? In 20 lb.? In 50 lb.? In 100 lb.?

8. At 4 ct. an ounce, what will a half pound of pepper cost?

9. What will 2 oz. of cinnamon cost at 60 ct. a pound?

10. How many 4-oz. tins of mustard may be filled from a box holding 10 lb.?

2000 pounds = 1 ton (T.)

Coal, hay, and other merchandise which is sold in large lots, are sold by weight estimated in tons and hundredweight. A hundredweight is only another name for 100 pounds. There are 20 hundredweight in a ton.

WRITTEN EXERCISE

1. A farmer sold 5 T. of hay at 80 ct. a hundredweight. How much money did he receive for the hay?

2. How many bushels of wheat are there in a cargo weighing 40 T., computing 60 lb. to the bushel?

3. How many 5-lb. bags of salt may be filled from a bin holding a ton of salt?

4. A grocer bought 20 bu. of potatoes at 75 ct. a bushel, and sold them at 5 ct. a quart. How much did he gain?

5. At 12 ct. a pound, what is the value of a bale of cotton? (A bale of cotton weighs 500 lb.)

REVIEW OF MEASURE OF TIME

ORAL EXERCISE

1. How many seconds in 10 min.? In 30 min.? In an hour?


2. How many minutes in $4\frac{1}{2}$ hr.? In $\frac{1}{4}$ day? In 10 hr.?

3. How many days in 48 hr.? In 72 hr.? In 9 wk.?

4. A watch ticks twice a second. How many times does it tick in a minute?

5. A fog bell strikes every 3 minutes. How many times does it strike in an hour?

6. How many lesson periods 20 min. long are there between 1 P.M. and 3 P.M.?



WRITTEN EXERCISE

1. A new moon appears about every four weeks. How many times during a year is there a new moon?

2. A clerk earns \$ 18 a week. What is his annual salary?

3. The clerk spends \$ 9 a week for board, \$ 10 a month for clothing, and \$ 1 a day for other expenses. What is his annual expenditure? How much does he save?

4. How many days elapse between the 29th day of June and the 8th day of September?

5. Deducting the 4 Sundays in the month of April, 1909, calculate a man's wages for the month at the rate of \$ $3\frac{1}{2}$ a day.

6. A lady spent \$ 1000 in traveling during the months of July, August, and September. What was the average daily expenditure?

7. A railroad carried 756,439 passengers during the month of February, 1909. What was the average number carried daily?

8. A train starts at a quarter to two and arrives at its destination at half past three. Its speed was at the rate of 40 mi. an hour. How far did it travel?

9. How many minutes elapse between 10.30 P.M. and 2.15 A.M.?

The Mile

5280 feet = 1 mile (mi.)

1760 yards = 1 mile

ORAL EXERCISE

1. Name a distance of about a mile in the neighborhood of the school.

2. How long does it take you to walk a mile? To run a mile?

3. A very fast train may go a mile a minute. How many miles can such a train go in $1\frac{1}{2}$ hr.?

4. The fastest horse can trot a mile in 2 min. In what time can he trot $\frac{1}{4}$ mi.?

5. How many feet in $\frac{1}{2}$ mi.? In $\frac{1}{4}$ mi.? In $\frac{1}{8}$ mi.?

6. How many yards in $\frac{1}{8}$ mi.? In $\frac{1}{4}$ mi.? In $\frac{1}{2}$ mi.?

7. A running track has 5 laps to the mile. How many yards in the length of the track?

WRITTEN EXERCISE

1. A telegraph company sets up its telegraph poles 80 ft. apart. How many poles will be needed to extend one of its lines 10 mi.?

2. The distance around a certain field is $\frac{1}{4}$ mi. How much will it cost to fence the field at the rate of 60 ct. a yard?

3. In the fence mentioned in example 2, the posts are to be set 8 ft. apart. How many posts will be needed?

4. A chain was stretched across a stream $\frac{1}{8}$ mi. wide. How many links in the chain, if each link is 8 in. long?

5. Add 870 ft., 550 ft., 920 ft., 2400 ft., 3600 ft., and find how many miles the sum is equal to.

ORAL EXERCISE

1. How many inches in 12 ft.? In 25 ft.? In 100 ft.? In $\frac{1}{4}$ ft.?

2. How many inches in a yard? In $\frac{1}{2}$ yd.? In $\frac{1}{4}$ yd.? In $\frac{1}{3}$ yd.?

3. How many feet in 100 in.? In 300 in.?

4. What is the sum of 2 ft. 3 in. and 1 ft. 9 in.?

Divisions of the Inch



How long is this rule?

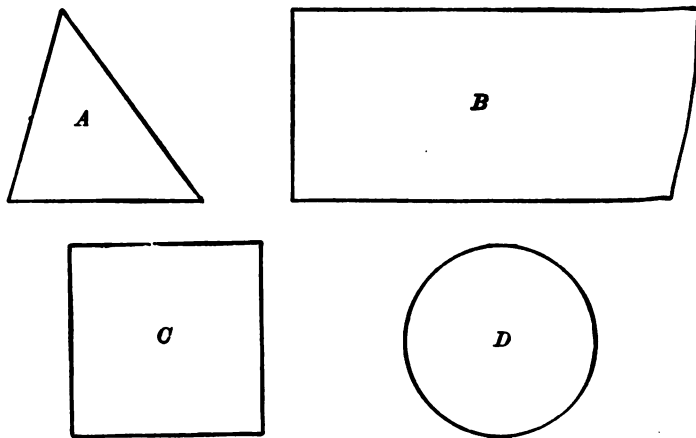
How many half inches in 3 in.?

How many quarter inches in 3 in.?

How many eighths of an inch in 3 in.?

Draw a line $4\frac{1}{2}$ in. long; $3\frac{1}{4}$ in., $5\frac{3}{4}$ in., $6\frac{3}{8}$ in., 1 ft. 2 in., $1' 11\frac{1}{8}"$, $3\frac{5}{8}"$, $2\frac{7}{8}"$, $1' 21\frac{1}{4}"$.

Surface and Figures



1. Draw lines dividing the surface of a sheet of paper into 2 equal parts.

2. Draw lines dividing the surface of a sheet of paper into 4 equal parts; into 8 equal parts.

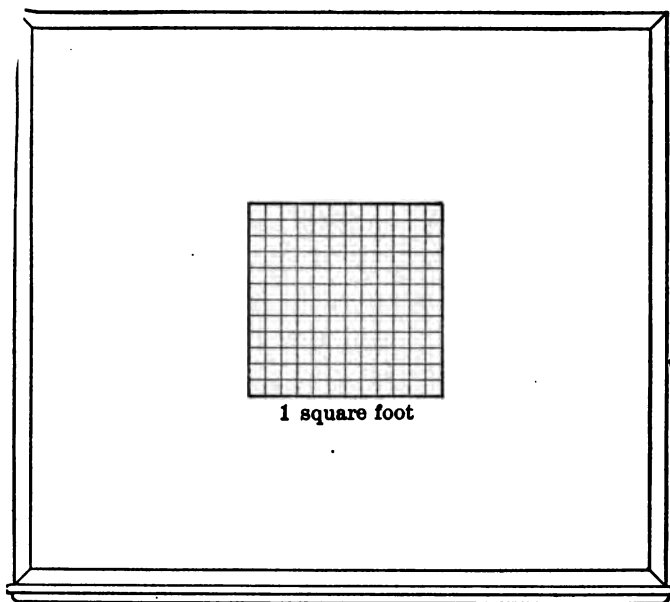
A part of the surface may be inclosed by 3 lines, as in Figure *A*; or by 4 lines, as in Figures *B* and *C*; or by a single curved line, as in Figure *D*.

3. Which of these figures is a triangle? A circle? A square? An oblong or rectangle?

4. How long is the oblong? How wide?

5. How long is the square? How wide?

6. Which figure has the largest area? Which figure has the smallest area?



ORAL EXERCISE I

1. Draw on the blackboard a foot square and place close beside it another foot square. How long is the resulting rectangle? How wide? How many square feet in this rectangle? How many square inches does the rectangle contain?

2. The top of a teacher's desk is 4 ft. long and 3 ft. wide. How many strips 4 ft. by 1 ft. may the top be divided into? What is the area of 1 strip? What is the area of the whole top?

To find the area of a rectangle divide it into strips and multiply the area of 1 strip by the number of strips.

ORAL EXERCISE II

1. How many square feet are there in a rectangle 1 ft. long and 2 ft. wide? Find the area of a rectangle 3 ft. long and 4 ft. wide; of a rectangle 7 ft. long and 8 ft. wide; of a square of 9 ft.

2. One rectangle is 1 ft. long and 2 ft. wide. Another rectangle is 1 ft. long and 3 ft. wide. How many more square feet are there in the second rectangle than in the first rectangle?

3. A rectangle has 8 sq. ft. in it. It is 2 ft. long. How wide is this rectangle?

4. How many square feet of paper will I need to cover a wall 8 ft. long and 9 ft. wide?

5. How many square feet of board will I need for the cover of a box that is 7 ft. long and 5 ft. wide?

6. A rug is 4 ft. long and 3 ft. wide. How much must I pay for it, if each square foot of the rug costs \$1?

7. How many square feet are there in a rectangle 5 ft. long and 8 ft. wide?

8. What is the difference in square feet between a rectangle 8 ft. long and 2 ft. wide, and a rectangle 4 ft. long and 2 ft. wide?

9. A plate glass window is 10 ft. long and 9 ft. wide. What was its cost at the rate of \$2 a square foot?

Approximations

(Test each area after the approximate answer has been given.)

1. What is the area of the top of your desk?
2. What is the area of the floor of the classroom? Of the ceiling? Of each wall?
3. What is the area of each picture in the room?
4. What is the area of the blackboard? Of the panes of glass in the windows?
5. What is the area of a page in your reader? Of this page in your arithmetic?

WRITTEN PROBLEMS

1. How many square feet are there in a store window 15 ft. high and 9 ft. wide?
2. A rectangle of bronze contains 44 sq. ft. It is 12 ft. long. How wide is it?
3. One table top is 3 ft. long and 7 ft. wide. Another table top is 8 ft. long and 4 ft. wide. Which is the larger table top? How many more square feet in the top of the larger table than in the top of the smaller one?
4. A strip of land is 125 ft. long and 8 ft. wide. How many square feet does it contain?
5. One hall contains 84 sq. ft. Another hall is 9 ft. long and 7 ft. wide. How much larger is the first hall than the second hall?

Drawing Lines to Scale

6"

A line 6 in. long cannot be drawn across this page, because the page is not wide enough; but the line may be represented by a shorter line which is marked 6".

1. Measure the actual length of the line in the picture.

2. 3 in. is what part of 6 in.?

When a line or distance is represented by a drawing half as large as the actual line or distance, we say that the drawing is made to the *scale* $\frac{1}{2}$ or to the *scale* 1 to 2.

3. Make drawings, to the scale $\frac{1}{2}$, of lines of the following lengths: 5 in., 8 in., 10 in., 12 in., 2 ft.

4. Make drawings, to the scale $\frac{1}{4}$, of these distances: 8 in., 12 in., 4 in., 2 in., 2 ft., 4 ft.

5. Make drawings, to the scale $\frac{1}{8}$, of lines having the following lengths: 8 in., 4 in., 12 in., 2 ft., 4 ft., 36 in.

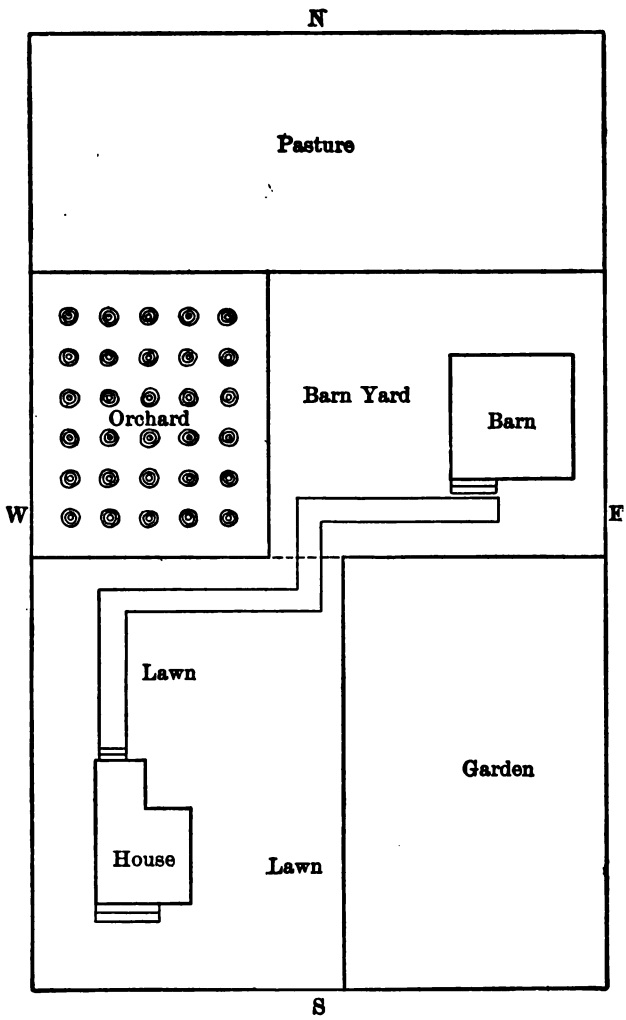
Drawing Flat Surfaces to Scale

1. Draw to scale, 1 in. to 1 ft., a rectangle 4 ft. long and $1\frac{1}{2}$ ft. wide.

2. Draw to scale, 1 in. to 1 ft., a 9-in. square.

3. Draw to scale, $\frac{1}{2}$ in. to 1 ft., a rectangle 10 ft. by 6 ft.

4. Draw to scale, $\frac{1}{8}$ in. to 1 ft., the floor of a room 24 ft. long and 16 ft. wide.



MAP OF HOUSE AND GROUNDS

MAP OF HOUSE AND GROUNDS

In the drawing the scale used is $\frac{1}{2}$ in. to 10 ft.

1. What are the real dimensions of the entire plot? Of the garden? Of the pasture? Of the orchard?

2. How wide is the house?

3. How long is the west side of the house?

4. What are the dimensions of the barn?

5. How far is it from the back door of the house to the barn door?

6. In the orchard the trees are in rows 20 ft. apart, the fence being 10 ft. distant from the nearest row of trees. How many long rows of trees? How many short rows? How many trees in the orchard?

7. The fence around the orchard cost 30 ct. a yard to erect. What was its entire cost?

8. The garden is planted with potatoes in hills 3 ft. apart, no hills being nearer than 3 ft. to the fence. How many hills of potatoes in the garden?

Plots of Land and Building Lots

This map represents a plot of land divided into building lots. Such lots are usually sold at a price *per foot of frontage* on the street. A lot whose side on the

street measures 50 ft. is called a 50-ft. lot. If such a lot were sold at \$10 *per front foot*, the selling price would be 50 times \$10, or \$500.

1. Using your rule, ascertain from the map the dimensions of each lot.

Street Front							
1	2	3	4	5	6	7	8
17	16	15	14	13	12	11	9

2. If the corner lots are valued at \$15 per front foot, what would each corner lot be worth?

Street Front
Scale $\frac{1}{4}" = 25'$

3. If the other lots are sold at \$10 per front foot, what would be the price of each of them?

4. An "improvement company" bought a plot of land 800 ft. square, one side of which is on a wide street. They wish to divide their land into city lots, 25 ft. front and 100 ft. deep. Make a map showing the best way to divide the plot so that every lot may have frontage on a street, the new streets to be 50 ft. wide.

5. A city block 325 ft. by 200 ft. having streets on all sides was purchased for \$325,000. The purchaser resold it in lots 20' by 100' at an average price of \$1000 per lot, except the corner lots, which he sold for \$2000 each. Find the total gain on the transaction.

REVIEW OF SQUARE MEASURE

1. How many square inches in 1 sq. ft.? In $\frac{1}{2}$ sq. ft.? In $\frac{1}{4}$ sq. ft.?

2. How many square inches in a surface 1 ft long and 8 in. wide?

How many square feet in a surface:

3. 4 ft. by 2 ft.?

6. 9 ft. by 5 ft.?

4. 6 ft. by 9 ft.?

7. 3 ft. by 7 ft.?

5. 5 ft. by 10 ft.?

8. 10 ft. by $5\frac{1}{2}$ ft.?

9. How long is a square yard? How wide?
How many square feet in a square yard?

REVIEW OF CUBIC MEASURE

1. How many inch cubes may be put into a box 8 in. by 4 in. by 2 in.?

2. How many inch cubes may be laid on a surface 1 ft. square?

3. How many inch cubes would there be if a second layer were laid upon the first layer (see example 2).

4. How many in 3 layers? In 10 layers?

5. How many inch cubes may be put into a box 1 ft. long, 1 ft. wide, and 1 ft. high?

6. Find the contents (number of cubic feet) of a bin 8 ft. long, 5 ft. wide, 4 ft. high.

7. How many cubic feet in a cubic yard?

Tables for Reference

LIQUID MEASURE

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
31½ gallons	= 1 barrel (bbl.)

DRY MEASURE

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

TABLE OF WEIGHT

16 ounces (oz.)	= 1 pound (lb.)
2000 pounds	= 1 ton (T.)

TABLE OF TIME

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
12 months (mo.)	= 1 year (yr.)
52 weeks	= 1 year
365 days	= 1 year
366 days	= 1 leap year

Thirty days has September,

April, June and November.

All the rest have thirty-one

~~Save~~ February alone,

Which has four and twenty-four

And every leap year one day more.

TABLE OF UNITED STATES MONEY

10 cents (ct.) = 1 dime (di.)

10 dimes = 1 dollar (\$)

LONG MEASURE

12 inches (in.) = 1 foot (ft.)

3 feet = 1 yard (yd.)

5½ yards = 1 rod (rd.)

320 rods

1760 yards } = 1 mile (mi.)

5280 feet }

SQUARE MEASURE

144 square inches (sq. in.) = 1 square foot (sq. ft.)

9 square feet = 1 square yard (sq. yd.)

30½ square yards = 1 square rod (sq. rd.)

160 square rods = 1 acre (A.)

640 acres = 1 square mile (sq. mi.)

CUBIC MEASURE

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)

27 cubic feet = 1 cubic yard (cu. yd.)

128 cubic feet = 1 cord (cd.)

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